PB88-213368

Background Document for First Third Wastes to Support 40 CFR Part 268, Land Disposal Restrictions. Proposed Rule. First Third Waste Volumes, Characteristics, and Required and Available Treatment Capacity. Part 2

Versar, Inc., Springfield, VA

Prepared for

Environmental Protection Agency, Washington, DC

May 88

U.S. Department of Commerce
National Technical Information Service
NTIS

United States
Environmental Protection
Agency

Office of
Solid Waste
Washington, D.C. 20460

May 1988

PB88-213368

EPA/530-SW-88-030

Solid Waste

EPA

Background Document For First Third Wastes To Support 40 CFR Part 268 Land Disposal Restrictions

Proposed Rule

First Third Waste Volumes, Characteristics, and Required and Available Treatment Capacity – Part II

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
SPRINGFIELD, VA. 22161

50272-101

REPORT DOCUMENTATION PAGE

1. REPORT NO. EPA/530-SW-88-030

2.

3. Recipient's Accession No. PB88-213368

4. Title and Subtitle
Background Document for First Third Wastes to Support 40 CFR Part 268 Land Disposal Restrictions. First Third Waste Volumes, Characteristics, and Required & Available Treatment Capacitity - Part II

5. Report Date May 1988

6.

7. Author(s)
EPA/Office of Solid Waste

8. Performing Organization Rept. No. 939.86

9. Performing Organization Name and Address
VERSAR, Inc.
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Springfield, VA 22151

10. Project/Task/Work Unit No. WA No. 86

11. Contract(C) or Grant(G) No.
(C) 68-01-7053
(G)

12. Sponsoring Organization Name and Address
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

13. Type of Report & Period Covered Proposed Rule

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

This document serves as a supporting background document for newly proposed EPA standards affecting the land disposal of first third wastes as well as solvent wastes, first third wastes as previously proposed, California list halogenated organic compound (HOC) wastes, and waste contaminated soils. The document discusses the required and available alternative treatment and recovery capacity for these wastes. The data used in developing these analyses were obtained from the results of the National Survey of Hazardous Waste Treatment, Storage, Disposal, and Recycling Facilities (the TSDR Survey)

17. Document Analysis a. Descriptors

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement RELEASE UNLIMITED

19. Security Class (This Report) UNCLASSIFIED

20. Security Class (This Page) UNCLASSIFIED

21. No. of Pages 204

22. Price PC$25.95/MF$6.95

(See ANSI-Z39.18)

See Instructions on Reverse

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

BACKGROUND DOCUMENT
FOR
FIRST THIRD WASTES TO SUPPORT 40 CFR PART 268 LAND DISPOSAL RESTRICTIONS

PROPOSED RULE

FIRST THIRD WASTE VOLUMES, CHARACTERISTICS, AND REQUIRED AND AVAILABLE TREATMENT CAPACITY - PART II

U.S. Environmental Protection Agency
Office of Solid Waste
401 M Street, S.W.
Washington, D.C. 20460

May 1988

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1.0 EXECUTIVE SUMMARY

This background document discusses the quantity of land disposed First Third wastes for which treatment standards are being proposed today and assesses the required and available alternative treatment and recovery capacity for these wastes. The document also includes a re-analysis of waste volumes affected and of required and available treatment capacity for solvent wastes, California List Halogenated Organic Compound (HOC) wastes, and First Third wastes as previously proposed, and solvent-, HOC-, and First Third waste-contaminated soils.

The data used to perform these analyses were obtained from a new data set created from the results of the National Survey of Hazardous Waste Treatment, Storage, Disposal, and Recycling Facilities (the TSDR Survey). The TSDR Survey is a census of all RCRA permitted and interim status treatment, disposal, and recycling facilities. Facility responses were reviewed for completeness and accuracy prior to inclusion in the data set. The data set contains detailed information on the volume and characteristics of wastes being land disposed and on the capacity of hazardous waste treatment/recovery technologies. The data set does not contain data on waste generation volumes.

Waste volumes affected by the restrictions were estimated and aggregated by waste code and land disposal practice. Treatability analyses were then performed on the affected wastes to determine the amount of required alternative treatment/recovery capacity. A facility-level capacity analysis was performed for each commercial treatment/recovery facility to determine estimates of the available capacities of alternative technologies. These available capacities were then aggregated to provide national estimates of commercially available treatment/recovery capacity. The estimates of available capacity were compared sequentially against the required capacity for the solvents, First Thirds, HOCs, and contaminated soils, in that order, to determine if adequate national capacity exists for the volume of waste being restricted from land disposal. The results of the analysis are presented below.

1.1 Solvent Wastes

Using the new TSDR Survey data set, it was estimated that 42 million gallons per year of land disposed solvent wastes will require alternative treatment/recovery capacity. The specific capacity requirements for these solvent wastes are presented below:

Technology	Available capacity (million gal/yr)	Required capacity (million gal/yr)
Combustion of:		
Liquids	247	1
Sludges/solids	47	38
Stabilization	429	2
Wastewater treatment:		
Cyanide oxidation	164	<1
Steam stripping, Carbon adsorption, Biological, or Wet air oxidation	75	1

The results of the analysis show that adequate capacity exists for the volume of solvent wastes requiring alternative treatment/recovery capacity.

1.2 First Third Wastes

Using the TSDR Survey data set, it was estimated that 431 million gallons per year of land disposed First Third wastes affected by today's proposed rule (i.e., those for which treatment standards will be established by August 8, 1988) will require alternative treatment/recovery capacity. First Third proposed wastes that also contain solvent wastes (F001-F005) were included in the solvent analysis and therefore are not included in the volume of First Third wastes. The specific capacity requirements for these First Third wastes are presented below:

Technology	Available capacity* (million gal/yr)	Required capacity (million gal/yr)
Combustion of:		
Liquids	246	<1
Sludges/solids	9	157
Stabilization	427	145
Metals recovery:		
Mercury retorting	0	<1
High temperature metals	34	83
Wastewater treatment:		
Cyanide oxidation	164	<1
Chromium reduction	195	41
Carbon adsorption and chromium reduction	12	1
Sludge treatment	0	4

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* The estimates of available capacity for First Third wastes were determined by subtracting the capacity required by solvent wastes from the national estimates of available capacity.

The results of the analysis show a shortfall in available capacity for sludges/solids combustion, metals recovery, and sludge treatment. The Agency is therefore proposing to grant a 2-year national capacity variance to K048, K049, K050, K051, and K052 wastes requiring sludges/solids combustion; K061 wastes requiring high temperature metals recovery; K106 wastes requiring mercury retorting, and K071 wastes requiring sludge treatment.

Presented below are the specific alternative capacity requirements for the First Third wastes affected by today's proposed rule following exclusion of the volumes of wastes for which the Agency is proposing to grant national capacity variances (i.e., K048-K052, K061, K071, and K106).

Technology	Available capacity* (million gal/yr)	Required capacity (million gal/yr)
Combustion of:		
Liquids	246	<1
Sludges/solids	9	5
Stabilization	427	128
Metals recovery:		
Mercury retorting	0	0
High temperature metals	34	0
Wastewater treatment:		
Cyanide oxidation	164	<1
Chromium reduction	195	41
Carbon adsorption and chromium reduction	12	0
Sludge treatment	0	0

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* The estimates of available capacity for First Third wastes were determined by subtracting the capacity required by solvent wastes from the national estimates of available capacity.

The results of this analysis show that adequate capacity does exist for the remaining First Third proposed wastes.

1.3 California List HOC Wastes

Using the TSDR Survey data set, it was estimated that approximately 4 million gallons per year of land disposed California List HOC wastes will require alternative treatment/recovery capacity. HOC wastes that also contain solvent wastes (F001-F005) or First Third wastes for which treatment standards are being proposed today were included in the analyses presented above and therefore are not included in the volume of HOC wastes.

The specific capacity requirements for the HOC wastes are presented below:

Technology	Available capacity* (million gal/yr)	Required capacity (million gal/yr)
Combustion of:		
Liquids	246	<1
Sludges/solids	4	2
Wastewater treatment for HOCs (Steam stripping, carbon adsorption, biological or wet air oxidation)	74	2

The Agency had previously granted a 2-year national capacity variance to HOC wastes requiring incineration. However, it has determined that adequate capacity does exist for the volume of HOC wastes requiring combustion. Consequently, the Agency is today proposing to rescind the capacity variance for HOC wastes requiring combustion.

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* The estimates of available capacity for HOC wastes were determined by subtracting the capacity required by solvent and First Third proposed wastes from the national estimates of available capacity.

The preamble to today's proposed rule presents available capacity estimates after assigning capacity to solvents and California List HOCs. This comparison is shown below:

Technology	Available capacity (million gal/yr)	Required capacity for solvents and HOCs (million gal/yr)	Remaining available capacity for First Third proposed wastes (million gal/yr)	Required capacity for First Third proposed wastes (million gal/yr)
Combustion of:				
Liquids	247	1	246	<1
Sludges/solids	47	40	7	157 (5)*
Stabilization	429	2	427	145
Metals recovery:				
Mercury retorting	0	0	0	<1 (0)*
High temperature metals	34	0	34	83 (0)*
Wastewater treatment:				
Cyanide oxidation	164	<1	164	<1
Chromium reduction	195	0	195	41
Carbon adsorption and chromium reduction	12	0	12	1
Steam stripping, Carbon adsorption, Biological, or Wet air oxidation	75	3	72	0
Sludge treatment	0	0	0	4 (0)*

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*Remaining volume after dropping waste volumes for which a capacity variance is being proposed.

1.4 Contaminated Soils

Because of the unique regulatory and treatability issues associated with contaminated soils, such wastes have been evaluated separately. Using the TSDR Survey data set, it was estimated that 48 million gallons per year of land disposed contaminated soils will require alternative treatment/recovery capacity.

The estimates of available capacity for contaminated soils were determined by first assigning the available national capacity to the non-soil solvent, First Third proposed, and HOC wastes. The specific capacity requirements for contaminated soils are presented below:

Technology/Regulatory Group	Available capacity (million gal/yr)	Required capacity (million gal/yr)
Combustion of soils contaminated with:		
- Solvents:	2	25
- First third proposed		11
- HOCs		4
		40
Stabilization of soils contaminated with:		
- Solvents	253	<1
- First Third proposed		8
		8

The analysis shows that adequate capacity exists for the volume of soils requiring stabilization. However, adequate capacity does not exist for the volume of soils requiring combustion.

2.0 INTRODUCTION

Today's proposed rule is the third segment of EPA's Land Disposal Restrictions Program - those for the "First Third" of the scheduled wastes. This section contains a brief summary of the legal background on the Land Disposal Restrictions Program, a summary of the results of capacity analyses to support prior restrictions, and an introduction to those wastes analyzed for this proposed rule.

2.1 Legal Background

The Hazardous and Solid Waste Amendments (HWSA) to RCRA, enacted on November 8, 1984, require the Agency to promulgate regulations that restrict the land disposal of hazardous wastes. Specifically, the amendments specify dates when particular groups of hazardous wastes are restricted from land disposal unless it has been demonstrated that there will be no migration of hazardous constituents from the disposal unit for as long as the waste remains hazardous.

The amendments also require the Agency to set levels or methods of treatment that substantially reduce the toxicity of the waste or the likelihood of migration of hazardous constituents from the waste. Wastes that meet treatment standards established by EPA are not prohibited and may be land disposed.

In the November 7, 1986, rulemaking (51 FR 40572), EPA promulgated a technology-based approach to establishing treatment standards. These treatment standards are generally based on the performance of the best demonstrated available technology (BDAT) identified for the hazardous constituents in a particular waste. EPA may establish treatment standards based on the performance of the BDAT treatment either as a specific technology or as concentration levels in the waste or treatment residual.

The land disposal restrictions are effective immediately upon promulgation unless the Agency grants a national capacity variance from the statutory date based upon a lack of adequate alternative treatment, recovery, or disposal capacity. To make this determination, EPA considers, on a national basis, both the capacity of alternative treatment/recovery technologies and the quantity of restricted wastes being land disposed. If adequate capacity is available, the restriction on land disposal goes into effect immediately upon promulgation. If there is a shortfall in national capacity, EPA may establish an alternative effective date based on the earliest date on which adequate capacity for treatment, recovery, or disposal that is protective of human health and the environment will be available.

2.2 Summary of Previous Land Disposal Restrictions

Presented in this section is a summary of the results of the capacity analyses to support previous land disposal restrictions. These analyses were performed using the best data available at the time to develop national estimates of the amount of waste land disposed and of available alternative commercial treatment capacity. Analyses of waste volumes affected considered the combination of waste code, physical/chemical form, and management practice for determination of the amount of alternative capacity required.

2.2.1 Solvents and Dioxins

The Land Disposal Restrictions Program began with the promulgation of the Solvents and Dioxins final rule on November 7, 1986 (51 FR 40572). The final rule encompassed F001-F005 spent solvent wastes and F020-F023 and F026-F028 dioxin wastes, and it established treatment standards expressed as concentrations in the waste extract. The rule prohibits land disposal of the solvent and dioxin wastes unless the wastes contain less than the specified concentrations of hazardous constituents.

For that final rule, EPA performed an analysis of required and available treatment/recovery capacity. The Agency used the 1981 Regulatory Impact Analysis (RIA) Mail Survey to identify the volume of land disposed solvent wastes subject to the restrictions. Although EPA did not establish required treatment technologies for these wastes, the Agency used the physical and chemical characteristics that were reported for each waste stream to identify the technology or technologies that EPA assumed would be used to meet the treatment standards. The waste volumes were distributed among the applicable technologies as shown below:

Waste stream	Applicable treatment and recovery technologies
Solvent-water mixtures	Wastewater treatment

Waste stream	Applicable treatment and recovery technologies
Organic liquids	Distillation Fuel substitution Incineration
Organic sludges	Fuel substitution Incineration
Inorganic sludges or solids	Incineration

After identifying the required alternative capacity for solvent wastes, the Agency analyzed the available commercial capacity for these technologies.

Analysis of available capacity (supply) and required capacity (demand) showed shortfalls in available capacity for wastewater treatment and incineration. Consequently, the Agency granted a 2-year national capacity variance to CERCLA and RCRA corrective action wastes; small quantity generator (SQG) wastes; and solvent-water mixtures, solvent-containing sludges, and solvent-contaminated soil containing less than 1 percent total F001-F005 solvent constituents (40 CFR 268.30 and Ref. 1).

EPA determined the volume of dioxin-containing waste generated annually and affected by the restrictions. Incineration capacity for these dioxin wastes was determined to be inadequate; therefore a 2-year national capacity variance was granted (51 FR 40617).

Today's proposed rule includes a re-analysis of available and required treatment capacity for solvent wastes using data from EPA's new data set based on the results of the National Survey of Hazardous Waste

Treatment, Storage, Disposal, and Recycling Facilities (the TSDR Survey). This data set is described in more detail in Sections 3 and 4.

2.2.2. California List

Unlike the Solvents and Dioxins rule, the California List rule is not waste code specific. The California List includes all liquid hazardous waste with a pH of ≤2.0 (i.e., acidic corrosive waste); all liquid hazardous waste containing free cyanide, metals, or polychlorinated biphenyls (PCBs) in concentrations greater than or equal to those specified; and all hazardous wastes (liquid or solid) containing halogenated organic compounds (HOCs) in amounts greater than or equal to the statutory levels.

The California List final rule was promulgated on July 8, 1987 (52 FR 25760). The Agency established BDAT as incineration in accordance with 40 CFR 264 Subpart O or Part 265 Subpart O for HOC wastes (except HOC wastewaters), and thermal treatment in accordance with 40 CFR 761.60 or 761.70 for PCB wastes. EPA codified the statutory prohibition level for acidic corrosive wastes (those with a pH ≤2.0) but did not promulgate a treatment standard for these wastes. The final rule did not establish prohibition levels for metal or cyanide wastes; a final determination for these wastes was to be made in a separate rulemaking.

The Agency used data from the 1981 RIA Mail Survey (Ref. 2) to determine the maximum potential volume of land disposed waste subject to the California List restrictions. To determine the required alternative treatment capacity for these waste volumes, EPA identified those technologies that it believed would generally be used to treat California List wastes. The Agency then determined the available alternative treatment capacity for these wastes.

A comparison of required and available treatment capacity for the California List wastes for which BDAT has been established showed that incineration capacity for HOC wastes was inadequate. Consequently, the Agency granted a 2-year national capacity variance to HOC wastes requiring incineration. On the other hand, the Agency determined that adequate capacity for PCB wastes exists, and thus did not grant a variance to these wastes. EPA believes that acidic corrosive, cyanide, and metal wastes can be treated to below the California List statutory levels by tank treatment methods including neutralization, cyanide oxidation, chromium reduction, and chemical precipitation. Since EPA did not establish a treatment standard for these wastes, however, they may still be land disposed after being rendered nonliquid. Consequently, the Agency believes that adequate capacity for these wastes exists, and did not grant a capacity variance for them (Ref. 3).

Today's proposed rule includes a re-analysis of required and available treatment capacity for California List HOC wastes based on the TSDR Survey data.

2.2.3 First Third Wastes

On April 8, 1988 (53 FR 11742), the Agency proposed its approach to regulating the land disposal of the so-called "First Third" wastes. At that time, EPA proposed treatment standards for only some of the First Third wastes, promising to continue analyses of additional First Third wastes and to publish a supplementary proposal.

The data used at that time to quantify and characterize the first group of First Third wastes was obtained from the 1981 RIA Mail Survey (Ref. 2). Using these data, an estimate of the maximum total volume of First Third wastes land disposed annually was made. The estimate represented a maximum volume because some double-counting of waste streams that were reported as being managed by more than one land disposal practice could not be avoided.

The Agency proposed treatment standards for K061, K062, K016, K018, K019, K020, K030, K024, K103, K104, K071, K048, K049, K050, K051, and K052. For K004, K008, K036, K073, and K100 wastes, a standard of "No Land Disposal" was proposed because the Agency believes that the wastes are no longer generated and therefore are not currently land disposed.

EPA did not require the use of Best Demonstrated Available Technologies (BDAT). Instead, the Agency established treatment standards expressed as concentration limits in the waste (or an extraction from the waste) and identified the BDAT technology on which these limitations are based. These technologies can be broadly categorized as follows: incineration, wastewater treatment, chemical treatment, wastewater treatment and incineration, and high temperature metals recovery. To determine the required treatment/recovery capacity, the Agency performed a treatability analysis of the First Third waste streams from the RIA Mail Survey that were affected by the proposal. Based on this analysis, EPA determined whether adequate available capacity existed for each waste code (Ref. 4).

For previous rulemakings, the Agency had determined that commercial rotary kiln and fluidized bed incineration capacity was insufficient for the volume potentially requiring commercial incineration (Ref. 4). Consequently, EPA proposed to grant a 2-year capacity variance to those wastes requiring rotary kiln or fluidized bed incineration (K016, K018, K019, K020, K024, K030, K037, K048, K049, K050, K051, and K052).

The Agency had previously demonstrated, however, that liquid combustion capacity was available in liquid injection incinerators and industrial kilns/furnaces (Ref. 4). As a result, EPA did not propose to grant a variance to K015 wastes requiring liquid injection incineration.

The Agency believed that adequate onsite wastewater treatment capacity for K062 existed at the time of proposal or would exist prior to promulgation of the final rule. In addition, some available commercial capacity had been identified (Ref. 4). Therefore, EPA did not propose to grant a variance for K062 wastes requiring wastewater treatment capacity.

Although EPA determined that adequate liquid injection incineration capacity was available for K103 and K104 wastes, the Agency believed that there was insufficient wastewater treatment capacity for these wastes. Therefore, EPA proposed to grant a 2-year national capacity variance to K103 and K104 wastes.

Similarly, EPA determined that adequate commercial high temperature metals recovery capacity did not exist for K061 wastes, and therefore proposed to grant a 2-year national capacity variance for K061 wastes.

The Agency also found that there was inadequate capacity for K071 wastes requiring chemical treatment, and proposed to grant a 2-year variance for K071 wastes.

Today's proposed rule contains a re-analysis of required and available treatment capacity for those First Third wastes previously proposed, based on the new TSDR Survey data set.

2.3 Introduction to Today's Proposal

Using the results of the the TSDR Survey, the Agency has re-analyzed the amount of required and available treatment/recovery capacity for solvent wastes and California list HOC wastes. An overview of the results of these re-analyses is contained in Section 3.2.2 for solvent wastes and Section 3.2.4 for HOCs, and detailed capacity analyses for solvent wastes and HOCs are contained in Appendices A and C, respectively.

Today, the Agency is also re-proposing the ban effective dates for some of those First Third wastes previously proposed (53 FR 11742), based on a re-analysis of the required and available treatment/recovery capacity for those wastes using the new data from the TSDR Survey. In addition, today's rule proposes treatment standards and ban effective dates for some additional First Third wastes.

Because of time constraints, EPA is proposing to establish treatment standards for only some of the First Third wastes. The wastes for which a treatment standard will be established by August 1988 are hereafter referred to in this document as "First Third proposed wastes" and include the waste codes identified in Table 2.3.1.

Those wastes for which a treatment standard is not being established are covered by the "soft hammer" provision of the statute. Basically, the soft hammer provision allows these wastes to be landfilled or disposed in an impoundment if it can be certified that such disposal is the only practical alternative to treatment currently available.

This document presents the results of the capacity analysis performed for First Third proposed wastes. An overview of the results of this analysis and a detailed code-by-code capacity analysis are contained in Section 3.2.3.

For a number of reasons the Agency has not re-evaluated the amount of required and available treatment capacity for California List wastes land disposed in "surface" disposal units (i.e., waste piles, surface impoundments, landfills, land treatment units, but not underground injection wells). First, by definition these wastes are liquids, or contain free liquids, therefore the vast majority of these wastes are managed in surface impoundments which must meet certain minimum technical (min-tech) standards by November of 1988 (or qualify for an exemption) to remain open. Wastes managed in "min-tech" treatment impoundments are no longer considered land disposed. Consequently, the Agency believes that by November of 1988 most of those wastes will either be treated on-site in tanks or "min-tech" treatment impoundments.

Secondly, those wastes that are not treated on-site in tanks or min-tech treatment impoundments need only be rendered non-liquid prior to land disposal. Therefore, an analysis of non-HOC California List wastes is not included in this document.

Table 2.3.1 First Third Proposed Wastes[1]

Waste code	Description
F006	Wastewater treatment sludges from certain electroplating operations
K001	Bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol
K004	Wastewater treatment sludge from the production of zinc yellow pigments
K008	Oven residue from the production of chrome oxide green pigments
K015	Still bottoms from the distillation of benzyl chloride
K016, K018, K019, K020	Heavy ends or distillation residues from production of certain halogenated organics
K021	Aqueous spent antimony catalyst waste from fluoromethanes production
K022	Distillation bottom tars from the production of phenol/acetone from cumene
K024	Distillation bottoms from the production of phthalic anhydride from naphthalene
K025	Distillation bottoms from the production of nitrobenzene by the nitration of benzene
K030	Column bottoms or heavy ends from the combined production of trichloroethylene and perchloroethylene
K036	Still bottoms from toluene reclamation distillation in the production of disulfoton
K037	Wastewater treatment sludges from the production of disulfoton
K044	Wastewater treatment sludges from the manufacturing and processing of explosives
K045	Spent carbon from the treatment of wastewater containing explosives
K046	Wastewater treatment sludges from the manufacturing, formulation, and loading of lead-based initiating compounds
K047	Pink/red water from TNT operations
K048-K052	Various wastes from the petroleum refining industry

Table 2.3.1 (continued)

Waste code	Description
K060	Ammonia still lime sludge from coking operations
K061	Emission control dust/sludge from the primary production of steel in electric furnaces
K062	Spent pickle liquor from steel finishing operations of plants that produce iron or steel
K069	Emission control dust/sludge from secondary lead smelting
K071	Brine purification muds from the mercury cell process in chlorine production, where separately prepurified brine is not used
K073	Chlorinated hydrocarbon waste from the purification step of the diaphragm cell process using graphite anodes in chlorine production
K086	Solvent washes and sludges, caustic washes and sludges, or water washes and sludges from cleaning tubs and equipment used in the formulation of ink from pigments, driers, soaps, and stabilizers containing chromium and lead
K087	Decanter tank tar sludge from coking operations
K099	Untreated wastewater from the production of 2,4-D
K100	Waste leaching solution from acid leaching of emission control dust/sludge from secondary lead smelting
K101	Distillation tar residues from the distillation of aniline-based compounds in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds
K102	Residue from the use of activated carbon for decolorization in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds
K103	Process residues from aniline extraction from the production of aniline
K104	Combined wastewater streams generated from nitrobenzene/aniline production
K106	Wastewater treatment sludge from the mercury cell process in chlorine production

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[1] The "First Third proposed" wastes are those wastes for which a treatment standard is being proposed today and will be established by August 8, 1988.

3.0 OVERVIEW

This section of the background document presents general discussions of the source(s) of data and analytical methodology used for the capacity analyses in support of this proposed rule. Also presented are the results of the analyses of waste volumes affected by the land disposal restrictions, the demand for alternative capacity, and available capacity.

3.1 General Methodology

3.1.1 Data Set Development

(1) National Survey of Hazardous Waste Treatment, Storage, Disposal, and Recycling Facilities.

Background. In order to improve the quality of data used for capacity analyses of hazardous waste volumes and management practices in support of the land disposal restrictions, EPA has conducted the National Survey of Hazardous Waste Treatment, Storage, Disposal, and Recycling Facilities (the TSDR Survey). The TSDR Survey was designed as a census of permitted or interim status treatment, recycling, and disposal facilities, with no weighting factors for statistical analyses to project national estimates. The survey results therefore provide a comprehensive source of waste volumes and treatment, recovery, and disposal capacity data. Only TSDR Survey data available as of April 11, 1988, were able to be used to support the capacity analyses for this proposed rule. There was extensive technical review and detailed analysis of the facility responses. Certain facility responses and derived data elements from the facility level analysis were incorporated into a specialized data set developed (a series of PC-based data systems) for land disposal. facilities and commercial treatment and recovery facilities.

Schedule and Status. The TSDR Survey was originally mailed to over 2,400 facilities in August 1987. Facilities were allowed 60 days to complete and return the surveys. Many facilities requested and were granted extensions of 30 days. Since August, an additional 200 facilities that were either initially overlooked or are new, have been identified and sent the TSDR Survey. Approximately 2,300 facilities had returned their survey as of April 11, 1988, the deadline for review and analysis of data for support of this proposed rule.

A total of 433 facilities reported onsite land disposal/land placement of 63 billion gallons of RCRA hazardous wastes during 1986, the baseline year for the survey. Over 99 percent of the data (by land disposal volume) were reviewed and included in the data set used to support this proposed rule.

Twenty-three facilities with land disposal have not returned their surveys to date. However, 18 of these late facilities provided limited information when contacted by phone. In total, these 18 facilities account for 813 million gallons of land disposed waste (excluding underground injection volumes), approximately less than two percent of the total reported volume. This results in a two percent error factor in the analysis. The Agency is assuming the wastes at these late facilities will reflect similar patterns to those of the wastes reported; therefore, no problems are anticipated in not having all the data available for this analysis.

A total of 310 facilities with commercial treatment/recovery technologies have completed and returned surveys, accounting for a maximum of 21 billion gallons per year of commercial hazardous waste alternative capacity in 1986. Some of these facilities also reported land disposal onsite, and are included in the 433 facilities noted above. However, the analysis was limited to only those technologies considered as the Best Demonstrated Available Technology (BDAT), or judged to be applicable, to the wastes covered by this proposal--solvents, California List HOCs (halogenated organic compounds), and First Third wastes, including contaminated soils.

Eighty-six facilities reported having commercial processes other than conbustion, mostly wastewater treatment capacity, that may be applicable as alternative treatment/recovery of the land disposed wastes of concern for this analysis, accounting for a maximum capacity of 2.5 billion gallons of commercial noncombustion treatment/recovery capacity in 1988.

Forty-three facilities reported commercial combustion processes (incineration or reuse as fuel in industrial kilns) that may be applicable for burning hazardous waste currently land disposed, accounting for a maximum capacity of 435 million gallons of commercial combustion capacity in 1988.

A total of 124 commercial treatment/recovery facilities have not returned their surveys to date. To fill known data gaps on these late facilities, limited phone contact was attempted to gather critical capacity information, and where available, other data sources were used.

Because of time constraints, not all of the information on commercial capacity for stabilization is included in these analyses. Also, only industrial kilns, not industrial boilers or other furnaces were considered in the analysis of commercial combustion capacity. Therefore, the available capacity reported for these technologies is an underestimate. However, the analysis shows there is more than enough capacity for the volume of wastes requiring these technologies.

Technology Capacity Information. The TSDR Survey was designed to provide comprehensive information on all current and planned hazardous waste treatment, recycling, and disposal processes at all RCRA permitted and interim status facilities, including information on exempt processes at these facilities (e.g., recycling, wastewater treatment).* The baseline year for the survey was 1986. Information on planned changes to existing processes and any new processes planned prior to 1992 was requested.

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* Exceptions to this include totally enclosed treatment facilities (TETFs) and closed loop recycling (CLR), which were not required to be reported. Also, no information was gathered at facilities with only exempt processes.

An overview of the information on treatment and recycling processes, including those taking place in land disposal units (i.e., land placement), is provided below:

• General categories (including new or planned processes)	- Type of process - Operating status - Commercial status - Permit status
• Key parameters	- Feed rates (by physical form) - Operating hours - Pollution controls
• Waste types	- Waste codes managed in 1986 - Restrictions or specifications for waste managed (for commercial facilities only)
• Capacity	- Maximum capacity (by physical form) - Utilization rate for 1986 - Planned changes
• Residuals	- Quantity generated (by physical form, percentage hazardous) - Further management
• Equipment (type of unit)	- Tanks - Containers - Thermal treatment units - Land disposal units (i.e., surface impoundments, waste piles)

For more detail, refer to the complete set of questionnaires and instructions in the Public Docket for this proposed rule.

Waste Volumes Land Disposed. The TSDR Survey was designed to provide detailed information on the types and quantities of all RCRA hazardous waste managed, by specific land disposal/land placement practices, at all RCRA permitted and interim status facilities. The survey provides limited but adequate characterization data (refer to Section 4.1.2) to assess the treatability potential of the wastes and to identify applicable alternative treatment/recovery technologies, including:

- RCRA waste code (or codes, if more than one is applicable)
- Waste description (physical/chemical form and qualitative information on hazardous constituents)
- Industry description (general description describing the industries that generated each type of waste at a facility)
- Quantity that entered land disposal/placement in 1986
- Residual information (was this waste a residual from onsite hazardous waste management operations)

The TSDR Survey also provides valuable information on the individual units in which land disposal/placement is occurring, including plans for closures and upgrading/retrofitting to meet the minimum technology requirements. Through review of the questionnaire responses and the facility schematics, it is possible to track individual waste streams managed in more than one type of land disposal unit or managed by more than one process (treatment, storage, or disposal) in surface impoundments and waste piles, to avoid double counting of waste volumes. An overview of this information is provided below:

- General categories
    - Type of process
    - Permit status
    - Commercial status
    - Operating status
    - Closure plans
- Key parameters
    - Liner type (plans for upgrading)
    - Pollution controls

• Waste types	- Waste types and quantities managed in 1986 - Restrictions of specifications for waste managed (for commercial facilities only)
• Capacity	- Design capacity - Utilization rate for 1986 - Remaining capacity - Planned changes
• Residuals	- Quantities of effluents and dredged solids - Further management

For more details, refer to the complete set of questionnaires in the Public Docket for this proposed rule.

The TSDR Survey was used as the primary comprehensive source of data on volumes and characteristics of wastes land disposed and required and available treatment/recovery capacity to support the land disposal restrictions under this proposed rule. A limited number of additional data sources were used to compensate for late or incomplete facility responses. These other data sources are discussed following the next subsection.

Overview of Data Handling, Technical Review, and Quality Assurance. Extensive technical review of TSDR Survey data was required to assure completeness, consistency, and accuracy on a per facility basis. In order to achieve this goal, the review process was designed to promote the consistent and efficient identification and resolution of any errors, inconsistencies, and omissions, including any required facility followup. The review procedures were comprehensive and required the consideration and analysis of the facility responses to essentially every question in the survey (if applicable to that facility), and the review and further development of general and detailed schematics of all onsite hazardous waste management operations. The detailed review procedures are presented in the Guidelines for Technical Review of TSDR Surveys (Ref. 5), available in the Public Docket for this proposed rule.

All surveys from TSDR facilities with onsite land disposal/placement (whether private or commercial) or commercial treatment/recovery operations were considered critical for support of the land disposal restrictions. Therefore, they were categorized as "priority" surveys, and were slated to undergo technical review and analysis immediately.

After a survey was determined to be priority, it was distributed to the review teams. Members of the review teams conducted the technical review. Following review, if the responses in a survey indicated that the facility had onsite land disposal/ placement, the required PC data sheets were completed immediately and the survey package underwent a preliminary quality control (QC) review by the team leaders. If no land disposal/placement operations were indicated, the review of commercial treatment/recovery operations proceeded, and upon completion, the survey package went to the team leaders for preliminary QC. As part of preliminary QC, the team leader then worked with the reviewer to correct or resolve any problems identified during the survey review (see Ref. 5 for details on the survey screening, distribution, and review procedures).

Treatability assessments were then conducted of each land disposed waste stream (described in Section 4.1.2) and onsite alternative treatment/recovery technologies were screened to determine potential applicability to land disposed/placed wastes. If any technologies were judged to be applicable, a capacity analysis was completed for those technologies (described in Section 4.2.1).

The last step in the review process consisted of complete or final QC. Approximately 25 percent of the surveys underwent complete QC (see Ref. 6 for detailed information on QC procedures). After QC, the technical review/analysis was considered to be complete.

(2) Other Data Sources. Additional data sources were used only when necessary to fill obvious data gaps with regard to the TSDR Survey. These sources were primarily used to provide supplemental data for facilities that were late in responding to the survey or for facilities that had provided incomplete responses and either would not or could not assist us in completing the responses.

Data from an earlier phone survey conducted for EPA on commercial capacity for burning hazardous organic wastes in industrial kilns were selectively used to supplement the survey data for several late or new facilities (Ref. 6). The information used involved five additional facilities operating cement kilns, providing both current and future commercial capacity for burning primary liquid hazardous wastes by fuel substitution (reuse as fuel).

In a very limited number of cases, commercial facilities that accepted large quantities of a variety of wastes for land disposal claimed that they were unable (or unwilling because of excessive efforts required) to provide detailed waste code, waste description, and quantity information for each land disposed waste stream. In order to fill such data gaps in the survey, it was necessary to attempt to gather these data from other sources. In most cases, facility contacts provided adequate information. However, for one facility information on hazardous wastes managed was obtained from the 1985 Biennial Reporting Data System, maintained by EPA.

In order to identify alternative treatment/recovery technologies (ATRs) applicable to the hazardous waste of concern, coordination was required with the BDAT (Best Demonstrated Available Technology) Program of EPA/OSW's Waste Treatment Branch. The ATRs used in the analysis of capacity for this proposed rule include those specific technologies employed by the BDAT Program to establish treatment standards for wastes restricted from land disposal, and in a limited number of cases, other potentially applicable ATRs (or combinations of these technologies, i.e., treatment trains), judged to be capable of meeting the treatment standards for certain wastes with unique characteristics for which the BDAT technology was not directly applicable (or applicable without pretreatment). In such cases (for unique treatabilty groups), various sources of published literature were used (described in more detail in

Section 4.1.2), and engineering judgment when necessary. Except for these few unique waste streams, the information on ATRs used to assess applicability to the wastes of concern and their ability to meet the treatment standards was provided by the BDAT Program.

3.1.2 General Capacity Analysis Methodology

The Agency is responsible for determining whether sufficient alternative capacity is available to meet the demand resulting from the land disposal restrictions. If the Agency determines that capacity is insufficient, it must then project the earliest date at which adequate capacity will be available.

To assess current capacity requirements, an analysis comparing required capacity with available capacity was performed. The comparison was performed on a waste stream by waste stream basis, by assessing waste treatability and using treatability as the link between the volumes of land disposed waste requiring alternative capacity and the appropriate available treatment/recovery capacity (refer to Section 4.1.2 for a more detailed discussion of treatability analysis).

Required Capacity. The required capacity, or capacity demand, consists of those volumes of wastes currently land disposed that will require alternative treatment when they are restricted from land disposal. The waste streams, along with their volumes, were identified and aggregated by similar treatability and by management practice. The management practices of concern are those practices classified as land disposal under HSWA and include: treatment, storage, or disposal in a surface impoundment; treatment or storage in a waste pile; land treatment; and disposal in a landfill. Utilization of salt dome formations, salt bed formations, and underground mines and caves are additional methods of land disposal that are affected by this rulemaking. Currently, there is insufficient information to document the volumes of First Third wastes disposed of by these last three methods; therefore, they are not addressed in the analysis of volumes and required alternative treatment capacity. Underground (deepwell) injection, another form of land disposal, will be covered under a separate rulemaking; thus, the volume of underground injected wastes has not been included in this document.

The volumes of waste reported in the TSDR Survey as land disposed in 1986 that require alternative treatment/recovery capacity were adjusted to reflect the rule that allows treatment in surface impoundments to be conducted only in impoundments meeting minimum technological requirements. Volumes of waste that were reported as continuing to be treated in non-minimum technology surface impoundments were considered to require alternative treatment capacity, while those undergoing treatment in impoundments meeting the requirements by 1988 or in impoundments being replaced by tank systems by 1988 were dropped from further analysis. The waste volumes requiring alternative capacity were identified by RCRA waste code(s) and by their land disposal ban regulatory status (i.e., solvents and dioxins, California list, or First Thirds). A detailed discussion of this methodology is presented in Section 4.1.1.

In order to determine the type of treatment capacity required by the affected wastes a treatability analysis was performed on each waste stream. Using the waste code, physical/chemical form data and the identified BDAT technology wastes were placed into treatability groups. For example, all wastes requiring sludge incineration would be placed in the same treatability group. The physical/chemical form data were provided by the facility using qualitative technical criteria, not regulatory definitions. For example, liquids wastes were identified as "highly fluid" rather than wastes failing the Paint Filter Liquids Test.

Waste groups (i.e., waste streams described by more than one waste code) present special treatability concerns because they are often contaminated with wastes requiring different treatment (e.g., organics and metals). To treat these wastes a treatment train must be developed which can treat all waste types in the group. A more detailed description of the treatability analysis methodology, including treatment train development, is contained in Section 4.1.2.

A number of the treatment technologies to which wastes have been assigned create treatment residuals which will require further treatment prior to land disposal (e.g., stabilization of incinerator ash). In these cases, the Agency has estimated the amount of residuals that would be generated by treatment of the original volume of waste requiring treatment and included these residuals in the volumes requiring treatment capacity. A more detail description of the determination of residual volumes is contained in Section 4.1.2(4).

BDAT for a number of wastes includes treatment of incinerator scrubber water. Based on TSDR Survey responses, the RCRA permitted incinerators have adequate air pollution control devices (APCDs) (including scrubber water treatment at those facilities with wet scrubbers), and therefore no additional analysis of the volume of scrubber water was made.

Available Capacity. The analysis of available capacity for treatment/recovery systems began at the facility level. TSDR Survey capacity data were reported on a unit process basis. To obtain estimates of available capacity that could be compared with capacity requirements of affected wastes, a systems analysis approach was taken. For this analysis, a system is defined as one or more different processes used together in one or more different units to treat or recover hazardous waste. The capacity of the treatment/recovery system may be limited by the capacity of one or more of the unit processes within the system. The available capacity of the system is determined by subtracting the utilized capacity of the system from the maximum capacity of the system. A detailed discussion of system capacity determination may be found in Section 4.2.2.

Comparing required capacity with available capacity begins at the facility level and moves to the national level as dictated by the available capacity and commercial status of applicable treatment/recovery systems. The available capacity of systems identified as private are only considered when judged to be applicable to wastes reported as being land disposed at that facility. The remaining volumes of waste still requiring treatment capacity are added to determine the national demand for commercial capacity of each alternative technology.

By comparing the required capacity with the available capacity, the Agency can identify capacity shortfalls and make determinations concerning variances. The comparative capacity analysis accounts for the sequential and cumulative effects of previous land disposal restrictions and for projected capacity changes after 1986 (the baseline year). The required capacity for solvents and dioxin wastes were assigned to available capacity first followed by First Third proposed wastes, California list HOCs and finally soils. In addition, available capacity was first assigned to all affected wastes land disposed in "surface" units (i.e., waste piles, surface impoundments, landfills, and land treatment but not underground injection wells), and then to contaminated soils. (The remaining capacity will then be assigned to underground injected wastes which will be considered in another rule.) The Agency believes that land disposal in surface units may represent a greater threat to human health and the environment than does the underground injection of wastes. Furthermore, contaminated soils are generally from clean-up operations which present an obvious threat.

3.2 Results

3.2.1 All RCRA Wastes

Table 3.2.1 presents estimates of the total volume of RCRA wastes that is land disposed annually. These volumes were compiled by adding all waste stream volumes managed by treatment, storage, or disposal in land disposal units. Separate waste volumes are shown for storage and treatment in waste piles; treatment, storage, and disposal in surface impoundments; and disposal in landfills and land treatment units. The baseline data for determining the volumes in Table 3.2.1 were the 1986 data from responses to the TSDR Survey. Data reported in tons were converted to gallons (using the conversion factor of 240 gallons/ton, based on density of water), to allow comparisons to available capacity in a standard unit. These reported 1986 volumes were adjusted subtracting volumes of waste managed in treatment surface impoundments that will undergo closure and be replaced by tanks or that will be retrofitted in order to meet minimum technology requirements by 1988.

In order to avoid double-counting of wastes that underwent more than one management operation in the same type of unit (e.g., storage and treatment in a waste pile), the following procedures were followed. In tabulating volumes of waste managed in surface impoundments and waste

Table 3.2.1 Overview of All RCRA Hazardous Waste

	Volume land disposed[1] (million gallons/year)
Storage only	
- Waste piles	95
- Surface impoundments	3,000
Treatment	
- Waste piles	63
- Surface impoundments	1,959
Disposal	
- Landfills	674
- Land treatment	84
- Surface impoundments	203
Total	6,078

[1] Baseline was TSDR Survey data for 1986 (facility responses as of April 11, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment impoundments retrofit to meet minimum technology requirements.

piles, any waste that underwent treatment in an impoundment or waste pile was reported in the "treatment" volume. Wastes stored in a surface impoundment or waste pile that never underwent treatment in the impoundment or waste pile were reported in the "storage only" volumes. In tabulating surface impoundment volumes, waste that was disposed of in surface impoundments but not also treated in the impoundment was included among "disposal" surface impoundment volumes.

The disposal volumes reported for each land disposal practice and type included some waste streams that were treated or stored in one type of land disposal unit and were then disposed of in another type. These waste streams were counted twice when the waste volumes by management practice were compiled. Double-counted volumes of this type accounting for about 14 million gallons of waste. When waste volumes were assigned to treatability groups this double counting was eliminated.

Not represented in the estimates presented in Table 3.2.1 are volumes of land disposed waste from facilities that did not return their TSDR Surveys before April 11, 1988. A telephone survey was conducted for these late facilities, with those facilities that responded reporting approximately 813 million gallons of land disposed waste in 1986. This represents less than two percent of the reported 1986 volumes of land disposed hazardous waste. Sufficient data were not available to determine specific management practices and RCRA waste codes associated with these volumes.

3.2.2 Solvents

Table 3.2.2 presents estimates of the that volume of solvents land disposed annually, by management practice and by type of land disposal unit. The same procedures described for the analysis of all RCRA wastes were used for estimating solvent volumes. In addition, as a worst case condition, the entire volume of any waste stream, for both single waste streams and waste groups, was considered if it contained any solvent wastes.

The volume of land disposed solvent wastes requiring alternative commercial treatment capacity, however, will be somewhat less. As discussed in Section 4, the Agency has assumed that the 12 million gallons of solvent wastes that were only stored in impoundments or waste piles do not require alternative treatment capacity (although they may require alternative storage capacity) because they are treated or disposed elsewhere. Furthermore, the facility level waste treatability and technology capacity analyses conducted on solvent wastes being land disposed determined that 9 million gallons of these wastes either had already been treated using the BDAT technology or could be treated onsite, and therefore were not included in the volumes requiring alternative commercial treatment capacity. Based on this, the Agency estimates that 65 million gallons of solvent wastes will require alternative treatment capacity on a commercial basis. This volume includes 25 million gallons of soil, which are included in a separate

Table 3.2.2 Overview of Solvents

	Land disposed volume[1] (million gallons/year)
Storage only	
- Waste piles	1
- Surface impoundments	11
Treatment	
- Waste piles	3
- Surface impoundments	<1
Disposal	
- Landfills	70
- Land treatment	<1
- Surface impoundments	<1
Total	85

[1] Baseline was TSDR Survey data for 1986 (facility responses as of April 11, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment impoundments retrofit to meet minimum technology requirements.

section of this document; therefore, it is estimated that only 40 million gallons of non-soil solvent, wastes will require alternative commercial treatment capacity. Finally, the Agency estimates that treatment of this 40 million gallons will generate 2 million gallons of waste residuals that will also require additional alternative treatment capacity.

Table 3.2.3 presents the estimates of national commercial capacity for the alternative technologies that are applicable to solvent wastes. However, due to the time constraints, not all of the facilities with commercial stabilization capacity have been included in the estimates of available capacity. Although the actual amount of available stabilization capacity facilities is therefore somewhat higher, there is more than enough available stabilization capacity for the volume of solvent wastes requiring stabilization.

Also presented are the estimates of annual land disposed waste volumes that require alternative commercial capacity (not including contaminated soils or underground injected wastes). As evident from the table, the Agency has determined that based on the new data available from results of the TSDR Survey, there is adequate capacity for all of the solvent wastes that will require alternative capacity.

The Agency believes that the capacity analysis previously conducted for these wastes was accurate at the time of promulgation, and therefore the variances granted at that time were justified (Ref. 1). However, principally because the data used for today's analysis adjusts for

Table 3.2.3 Solvent Capacity Analysis

Technology	Available capacity (million gal/yr)	Required capacity (million gal/yr)
Combustion		
- Liquids	247	1
- Sludges/solids	47	38
Stabilization of incinerator ash	>429	2
Wastewater treatment		
- Cyanide oxidation, chemical precipitation and settling/filtration	164	<1
- Steam stripping, Carbon adsorption, Biological treatment, or Wet air oxidation	75	1

treatment impoundments that are being replaced by tanks or retrofit, the Agency believes that adequate capacity does now exist for solvent wastes. Also, there were significant increases in available commercial incineration capacity since promulgation of the land disposal restrictions rules for solvents.

3.2.3 First Third Wastes

(1) First Third Wastes. Table 3.2.4 presents the estimates of all First Third wastes land disposed annually, by management practice and by type of disposal unit. These are the first of the scheduled wastes, and are required to be evaluated by August 8, 1988. The same procedures described for the analysis of all RCRA wastes (Section 3.2.1) were used for estimating First Third waste volumes. However, in the worst case analysis for First Third wastes, the total volume for each category in Table 3.2.4 represents the sum of all single First Third waste streams and all waste groups containing at least one First Third waste but no solvents. This prevents double-counting of multiple waste streams that contain both First Third wastes and solvents.

(2) First Third Proposed Wastes. Table 3.2.5 presents estimates of "First Third proposed wastes" land disposed annually, by management practice and type of disposal unit. These are the First Third wastes for which treatment standards are being proposed today and are to be established by August 8, 1988. The same procedures described for the analysis of all RCRA wastes were used for estimating First Third proposed

Table 3.2.4 Overview of All First Third Wastes

	Land disposed volume[1] (million gallons/year)
Storage only	
- Waste piles	48
- Surface impoundments	6
Treatment	
- Waste piles	29
- Surface impoundments	612
Disposal	
- Landfills	303
- Land treatment	77
- Surface impoundments	78
Total	1,153

[1] Baseline was TSDR Survey data for 1986 (facility responses as of April 11, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment impoundments retrofit to meet minimum technology requirements.

Table 3.2.5 Overview of First Third Proposed Wastes[1]

	Land disposed volume[2] (million gallons/year)
Storage only	
- Waste piles	40
- Surface impoundments	4
Treatment	
- Waste piles	27
- Surface impoundments	321
Disposal	
- Landfills	286
- Land treatment	77
- Surface impoundments	78
Total	833

[1] First Third Proposed wastes are those wastes for which treatment standards are being proposed today and will be established by August 8, 1988.

[2] Baseline was TSDR Survey data for 1986 (facility responses as of April 11, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment impoundments retrofit to meet minimum technology requirements.

waste volumes. In the worst case analysis for First Third proposed wastes, the total volume for each category in Table 3.2.5 represents the sum of all single First Third proposed waste streams and all waste groups containing at least one First Third proposed waste, but no solvents. This prevents double-counting of multiple waste streams that contain First Third proposed wastes and solvents.

Table 3.2.6 presents the estimates of national capacity for the alternative technologies applicable to the First Third proposed wastes. Also presented are the estimates of annual land disposed waste volumes requiring alternative commercial capacity excluding First Third proposed wastes that are underground injected or soils contaminated with First Third proposed wastes. In most cases, there is adequate available capacity to treat all of the First Third proposed wastes and mixed waste groups containing a First Third proposed waste.

As Table 3.2.6 shows, there are three technologies that have required capacity (demand) exceeding the available capacity (supply). They are acid leaching of sludges, high temperature metals recovery, and combustion of sludges/solids. Therefore, because BDAT for K061 is high temperature metals recovery and BDAT for K071 is acid leaching of the sludge, the Agency is proposing a two year national capacity variance for these two waste codes. The required capacity for the combustion of sludges/solids is divided into two numbers. They are the amount of K048-K052 waste that requires sludge/solid combustion, 157 million

Table 3.2.6 1988 Capacity Analysis for
First Third Proposed Wastes

Technology	Available capacity (million gal/yr)	Required commercial capacity (million gal/yr)
Combustion		
- Liquids	~~296~~ 246	<1
- Sludges/solids	9	157 (5)[1]
Solidification	>427	145
Metals recovery		
- Mercury retorting	0	<1
- High temperature metals recovery (not secondary smelting)	34	83
Wastewater treatment		
- Cyanide oxidation, chemical precipitation and settling/filtration	164	<1
- Chromium reduction, chemical precipitation, and settling/filtration	195	41
- Carbon adsorption and chromium reduction, chemical precipitation, and settling/filtration	12	1
Sludge Treatment		
- Acid leaching, chemical oxidation, and dewatering of sludge and sulfide precipitation of effluent	0	4

[1] This volume is non K048-K052 First Third wastes.

gallons, and the amount of First Third proposed waste other than K048-K052 waste that requires sludge/solids combustion, 5 million gallons. Due to a shortfall of sludge/solids incineration capacity, the Agency will is proposing a two year national capacity variance for K048-K052 wastes.

The volume of land disposed First Third Proposed Wastes requiring alternative commercial treatment capacity, however, will be somewhat less. The Agency has assumed that 34 million gallons of the 44 million gallons that were only stored in impoundments or waste piles do not require alternative treatment capacity (although they may require alternative storage capacity) because they are treated or disposed elsewhere. The 10 million gallons of stored only wastes that do require alternative capacity were determined to have undergone "long term storage," and therefore would not be reported elsewhere as treated or disposed (for more detail on storage only waste volumes see Section 4.1.1). Furthermore, the facility level waste treatability and technology capacity analyses conducted on First Third wastes being land disposed determined that 357 million gallons of these wastes either had already been treated using the BDAT technology or could be treated onsite and therefore do not require alternative commercial treatment capacity. In addition, 10 million gallons were reported as having been managd in more than one type of land disposal unit, e.g., treated in a surface impoundment and disposed in a landfill, impoundment or by land treatment and are "double-counted" in Table 3.2.5. These waste volumes have, however, been counted only once in the volume requiring alternative commercial treatment capacity.

Based on this analysis, the Agency estimates that 432 million gallons of First Third Proposed wastes will require alternative commercial treatment capacity. This volume includes 18 million gallons of soils which are included in a separate section of this document; therefore, it is estimated that 414 million gallons of non-soil First Third Proposed wastes will require alternative commercial treatment capacity. Finally, the Agency estimates that treatment of this 414 million gallons will generate 17 million gallons of waste residuals that will require additional alternative treatment capacity.

(3) First Third (Not Proposed) Wastes. Table 3.2.7 presents estimates of annual land disposed volumes for those "not proposed" First Third wastes, by management practice and type of disposal unit. These are the First Third wastes for which no treatment standards will be established by August 8, 1988. The same procedures described for the analyses all RCRA wastes were used for estimating not proposed First Third waste volumes. However, in the worst case analysis for First Third proposed wastes, the total volume for each category in Table 3.2.7 represents the sum of all single, First Third not proposed waste streams and all waste groups containing at least one First Third not proposed waste, but no First Third proposed wastes or solvents. This prevents

Table 3.2.7 Overview of First Third Not Being Proposed[1]

	Land disposed volume[2] (million gallons/year)
Storage only	
- Waste piles	8
- Surface impoundments	2
Treatment	
- Waste piles	2
- Surface impoundments	291
Disposal	
- Landfills	17
- Land treatment	<1
- Surface impoundments	<1
Total	320

[1] The First Third wastes other than those wastes for which treatment standards are being proposed today and will be established by August 8, 1988.

[2] Baseline was TSDR Survey data for 1986 (facility responses as of April 11, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment impoundments retrofit to meet minimum technology requirements.

double-counting of multiple waste streams that contain First Third not proposed wastes, First Third proposed wastes, and solvents.

3.2.4 Waste Code Specific Capacity Analysis

This section presents the results of the analysis of required capacity for each alternative technology on a waste code-by-waste code basis. The tables show both the total amount of required treatment capacity for each of the First Third proposed waste codes and the amount of required capacity for each technology. Tables 3.2.8 through 3.2.28 present waste code-by-waste code analysis of the treatment capacity required by each First Third proposed waste.

The TSDR Survey data were sorted by waste code and type of alternative treatment required. The information was then combined and summarized to create the technology-specific and waste code-specific capacity analysis tables for First Third proposed wastes.

Also presented are discussions for each waste code. Each discussion contains a description of the waste, identifies the hazardous constituents for which it is listed, and identifies the BDAT technology used to set the proposed treatment standard.

For a limited number of waste streams, it was not feasible to assign them directly to the BDAT technology, and therefore, the waste was assigned to an alternative technology. In these few cases, the waste code discussions explain why the waste stream could not be directly assigned to BDAT and how the stream was handled. (Section 4.1.2 explains the methodology used to assign alternative technologies.)

F006

RCRA hazardous waste F006 is described as wastewater treatment sludges from certain electroplating operations. It is listed as a hazardous waste because of the presence of cadmium, hexavalent chromium, nickel, and cyanide (complexed). Table 3.2.8 shows the volume of F006 estimated to require alternate treatment based on the TSDR Survey results. The table also identifies the alternative treatment technologies assumed necessary for F006.

The Agency has identified the BDAT technology for F006 to be stabilization. As shown in Table 3.2.8, most of the F006 requiring alternate treatment was assigned to the BDAT technology. Several waste streams reported in the TSDR Survey and determined to require alternative treatment were described as sludges or solids consisting of F006 and organic wastes such as K016. These waste streams were assigned to incineration with chromium reduction, chemical precipitation of the scrubber water, and stabilization of the scrubber water treatment sludge and the incinerator ash. Table 3.2.8 shows the volumes of F006 that will require this treatment. The F006 that was assigned to chromium reduction was a single waste stream reported by one facility. The waste stream was described as a wastewater or aqueous mixture, which had already been treated for cyanides at the facility and was being disposed of in a surface impoundment. This waste stream would normally be discharged under a NPDES permit; however, the Agency conservatively assumes the

Table 3.2.8 Capacity Analysis For F006[1]

Type of alternative treatment/recovery	1988 Volume needing alternative capacity (gallons/year)
Combustion of sludges/solids	253,920
Stabilization of incinerator ash	50,784
Stabilization of scrubber water treatment sludge	2,539
Stabilization	125,543,954
Wastewater treatment: cyanide oxidation	223,605
Wastewater treatment: chromium reduction	551,920
stabilization of wastewater treatment sludge	226,888
Total	126,853,610

[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

wastewater will require further treatment. Therefore, the waste stream was assigned to chromium reduction followed by chemical precipitation, sludge dewatering, and stabilization of the wastewater treatment sludge.

The F006 waste assigned to cyanide oxidation are several waste streams described as untreated plating sludge with cyanides and metal-cyanide salts/chemicals. Based on the waste descriptions and other information in the survey, the Agency assigned the waste to slurrying followed by cyanide oxidation, chemical precipitation, sludge dewatering, and stabilization of the wastewater treatment sludge. The estimated volumes of wastewater treatment sludge from chromium reduction and cyanide oxidation requiring stabilization are also presented in Table 3.2.8.

Based on the information in the TSDR Survey, the Agency believes that adequate wastewater treatment, incineration, and stabilization capacity exists for F006. Therefore, the Agency is not proposing to grant a capacity variance from the ban effective date for F006 waste requiring alternate treatment.

K001

RCRA hazardous waste K001 is described as bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol. K001 is listed as a hazardous waste because of the presence of toxic organics. The Agency has identified the BDAT technology for K001 to be incineration with chemical precipitation of the scrubber water and stabilization of the scrubber water treatment sludge and incinerator ash. As shown in Table 3.2.9, all of the K001 identified from the TSDR Survey as requiring alternate treatment was assigned to this BDAT technology.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for K001 and for further treatment of the residuals. Therefore, the Agency does not propose to grant a capacity variance from the ban effective date for K001 wastes requiring alternate treatment.

Table 3.2.9 Capacity Analysis For K001[1]

Type of alternative treatment/recovery		1988 Volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		2,176,398
Stabilization of incinerator ash		217,688
Stabilization of scrubber water treatment sludge		21,764
	Total	2,415,850

[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K016

RCRA hazardous waste K016 is described as heavy ends or distillation residues from the production of carbon tetrachloride. K016 is listed as a hazardous waste because of the presence of toxic organics. The Agency has identified the BDAT technology for K016 to be incineration. As shown in Table 3.2.10, all of the K016 identified from the TSDR Survey as requiring alternate treatment was assigned to this BDAT technology. The BDAT treatment of K016 would not normally require chromium reduction and chemical precipitation of the scrubber water, and stabilization of the scrubber water treatment sludge and the incinerator ash. However, because several facilities reported mixed waste streams of K016 and metals bearing wastes, the Agency assumed that these mixed waste streams would require this additional treatment. Table 3.2.10 also shows the volume of K016 estimated to require this treatment.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for K016. Therefore, the Agency does not propose to grant a capacity variance from the ban effective date for K016 wastes requiring alternate treatment.

Table 3.2.10 Capacity Analysis For K016[1]

Type of alternative treatment/recovery		1988 Volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		279,600
Stabilization of incinerator ash		53,880
Stabilization of scrubber water treatment sludge		2,592
	Total	336,072

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[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K019

RCRA hazardous waste K019 is described as heavy ends from the distillation of ethylene dichloride in ethylene dichloride production. K019 is listed as a hazardous waste because of the presence of toxic organics. The Agency has identified the BDAT technology for K019 to be incineration. As shown in Table 3.2.11, all of the K019 identified from the TSDR Survey as requiring alternate treatment was assigned to this BDAT technology. The BDAT treatment of K019 would not normally require chromium reduction and chemical precipitation of the scrubber water, and stabilization of the scrubber water treatment sludge and the incinerator ash. However, because several facilities reported mixed waste streams of K019 and metals bearing wastes, the Agency assumed that these mixed waste streams would require this additional treatment. Table 3.2.11 also shows the volume of K019 estimated to require this treatment.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for K019. Therefore, the Agency does not propose to grant a capacity variance from the ban effective date for K019 waste requiring alternate treatment.

Table 3.2.11 Capacity Analysis For K019[1]

Type of alternative treatment/recovery		1988 Volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		75,240
Stabilization of incinerator ash		1,416
Stabilization of scrubber water treatment sludge		100
	Total	76,756

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[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K020

RCRA hazardous waste K020 is described as heavy ends from the distillation of vinyl chloride in vinyl chloride monomer production. K020 is listed as a hazardous waste because of the presence of toxic organics. The Agency has identified the BDAT technology for K020 to be incineration. As shown in Table 3.2.12, all of the K020 identified from the TSDR Survey as requiring alternate treatment was assigned to this BDAT technology. The BDAT treatment of K020 would not normally require chromium reduction and chemical precipitation of the scrubber water, and stabilization of the scrubber water treatment sludge and the incinerator ash. However, because several facilities reported mixed waste streams of K020 and metals bearing wastes, the Agency assumed that these mixed waste streams would require this additional treatment. Table 3.2.12 also shows the volume of K020 estimated to require this treatment.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for K020. Therefore, the Agency does not propose to grant a capacity variance from the ban effective date for K020 wastes requiring alternate treatment.

Table 3.2.12 Capacity Analysis For K020[1]

Type of alternative treatment/recovery		1988 Volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		27,000
Stabilization of incinerator ash		360
Stabilization of scrubber water treatment sludge		50
	Total	27,410

[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K022

RCRA hazardous waste K022 is described as distillation bottom tars from the production of phenol/acetone from cumene. K022 is listed as a hazardous waste because of the presence of phenol and tars (polycyclic aromatic hydrocarbons). The Agency has identified the BDAT technology for K020 to be incineration stabilization of incinerator ash. As shown in Table 3.2.13, all of the K022 identified from the TSDR Survey as requiring alternate treatment was assigned to this BDAT technology.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for K022. Therefore, the Agency does not propose to grant a capacity variance from the ban effective date for K022 wastes requiring alternate treatment.

Table 3.2.13 Capacity Analysis For K022[1]

Type of alternative treatment/recovery		1988 Volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		59,520
Stabilization of incinerator ash		8,040
	Total	67,560

[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K024

RCRA hazardous waste K024 is described as distillation bottoms from the production of phthalic anhydride from naphthalene. K024 is listed as a hazardous waste because of the presence of phthalic anhydride and 1,4-naphthoquinone. The Agency has identified the BDAT technology for K024 to be incineration. As shown in Table 3.2.14, all of the K024 identified from the TSDR Survey as requiring alternate treatment was assigned to this BDAT technology. The BDAT treatment of K024 would not normally require chromium reduction and chemical precipitation of the scrubber water, and stabilization of the scrubber water treatment sludge and the incinerator ash. However, because several facilities reported mixed waste streams of K024 and metals bearing wastes, the Agency assumed that these mixed waste streams would require this additional treatment. Tabld 3.2.14 also shows the volume of K024 estimated to require this treatment.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for K024. Therefore, the Agency does not propose to grant a capacity variance from the ban effective date for K024 wastes requiring alternate treatment.

Table 3.2.14 Capacity Analysis For K024[1]

Type of alternative treatment/recovery		1988 Volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		195,705
Stabilization of incinerator ash		16,917
Stabilization of scrubber water treatment sludge		1,268
	Total	213,890

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[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K030

RCRA hazardous waste K030 is described as column bottom or heavy ends from the combined production of trichloroethylene and perchloroethylene. K030 is listed as a hazardous waste because of the presence of toxic organics. The Agency has identified the BDAT technology for K030 to be incineration. The BDAT treatment of K030 does not require the treatment of scrubber water and incinerator ash. As shown in Table 3.2.15, all of the K030 identified from the TSDR Survey as requiring alternate treatment was assigned to this BDAT technology. K030 was not reported as being mixed with any metals bearing wastes in the TSDR Survey; therefore, the treatment of scurbber water and incinerator ash for mixed waste streams was not necessary.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration capacity exists for K030. Therefore, the Agency does not propose to grant a capacity variance from the ban effective date for K030 wastes requiring alternate treatment.

Table 3.2.15 Capacity Analysis For K030[1]

Type of alternative treatment/recovery	1988 Volume needing alternative capacity (gallons/year)
Combustion of sludges/solids	10,560

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[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K037

RCRA hazardous waste K037 is described as wastewater treatment sludges from the production of disulfoton. K037 is listed as a hazardous waste because of the presence of toluene and phosphorodithioic and phosphorothioic acid esters. The Agency has identified the BDAT technology for K037 to be incineration. The BDAT treatment of K030 does not require treatment of scrubber water and incinerator ash. As shown in Table 3.2.16, all of the K037 identified from the TSDR Survey as requiring alternate treatment was assigned to this BDAT technology. K037 was not reported as being mixed with any metals bearing wastes in the TSDR Survey; therefore, the treatment of scrubber water and incinerator ash for mixed waste streams was not necessary.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration capacity exists for K037. Therefore, the Agency does not propose to grant a capacity variance from the ban effective date for K037 wastes requiring alternate treatment.

Table 3.2.16 Capacity Analysis For K037[1]

Type of alternative treatment/recovery	1988 Volume needing alternative capacity (gallons/year)
Combustion of sludges/solids	11,131

[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K044

RCRA hazardous waste K044 is described as wastewater treatment sludges from the manufacturing and processing of explosives. K044 is listed as a hazardous waste because the waste is reactive. The Agency has identified the BDAT technology for K044 to be open burning. The TSDR Survey identified two K044 waste streams requiring alternate treatment. Both of these waste streams were reported as being mixed with K046. One K044 and K046 mixed waste stream was reported by a commercial landfill. Based on the information reported in the TSDR Survey for this facility, the Agency assumed that the waste no longer displayed explosive properties. Therefore, the waste was no longer reactive and did not meet the characteristic of K044 waste. Because of this, the entire volume of this waste stream was assigned to K046. The other K044 and K046 mixed waste stream was described as "dry" lime or metal hydroxide solids not "fixed". Again, based on the information reported in the TSDR Survey, the Agency assumed that the waste stream no longer met the characteristic of K044 (reactive) and therefore the entire volume was also assigned to K046.

Based on the information in the TSDR Survey, the Agency has identified no waste streams showing the characteristic of K044 that will require alternate treatment. Therefore, the Agency is not proposing to grant a capacity variance from the ban effective date for K044 wastes.

K046

RCRA hazardous waste K046 is described as wastewater treatment sludges from the manufacturing, formulation, and loading of lead-based initiating compounds. K046 is listed as a hazardous waste because of the presence of lead. The Agency has identified the BDAT technology for K046 to be stabilization. As shown in Table 3.2.17, the largest volume of K046 identified by the TSDR Survey as requiring alternate treatment was assigned to this BDAT technology. The waste assigned to stabilization was a single K044 and K046 mixed waste stream reported by a commercial landfill. Based on the information reported in the TSDR Survey for this facility, the Agency assumed that the waste did not display the characteristic of K044 waste (reactive). Therefore, the waste stream was assigned the BDAT technology for K046.

The K046 waste that was assigned cyanide oxidation was a single waste stream reported in the TSDR Survey. The waste stream was described as "dry" lime or metal hydroxide solids not "fixed." The K046 was reported as being mixed with K044 and cyanide bearing wastes. Again, based on the information reported in the TSDR Survey, the Agency assumed that the waste stream did not meet the characteristic of K044 waste. Therefore, the Agency assumed that the waste stream would require slurrying followed by cyanide oxidation, chemical precipitation, and sludge dewatering. The estimated volume of wastewater treatment sludge requiring stabilization is also presented in Table 3.2.17. The volume of wastewater treatment

Table 3.2.17 Capacity Analysis For K046[1]

		1988 Volume needing alternative capacity (gallons/year)
Type of alternative treatment/recovery		
Stabilization		1,581,160
Wastewater treatment: cyanide oxidation		1,600
Stabilization of wastewater treatment sludge		1,584
	Total	1,584,344

[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

sludge requiring solidification/stabilization is slightly inflated because the waste was reported as a solid and is assumed to require slurrying prior to treatment.

Based on the information from the TSDR Survey, the Agency believes that adequate cyanide oxidation and stabilization capacity exists for K046. Therefore, the Agency is not proposing to grant a capacity variance from the ban effective date to K046 wastes requiring alternate treatment.

K048 through K052

The petroleum refining industry generates five wastes listed in the Code of Federal Regulations. They are K048, K049, K050, K051, and K052. K048 is described as dissolved air flotation (DAF) float, K049 is described as slop oil emulsion solids, K050 is described as heat exchanger bundle cleaning sludge, K051 is described as API separator sludge, and K052 is described as tank bottoms (leaded). K048, K049, and K051 are listed for containing hexavalent chromium and lead; K050 is listed for containing hexavalent chromium; and K052 is listed for containing lead. The vast majority of waste generated by the petroleum refining industry is K048, K049, and K051. The Agency has identified the BDAT technology for K048-K052 waste streams to be incineration, chromium reduction and chemical precipitation of the scrubber water, and stabilization of the scrubber water treatment sludge and the incinerator ash.

Table 3.2.18 shows the volumes of K048-52 wastes which, based on the results of the TSDR Survey, require alternate treatment. Table 3.2.18 also shows the treatment technologies assigned to the K048-52 wastes.

Treatability analysis and assignment of treatment technologies to the petroleum refining wastes is influenced by two factors: waste composition and physical form. All five of the petroleum refining wastes can be described as an organic sludge containing metals; hence, they can be assigned to the same BDAT treatment technology.

Table 3.2.18 Capacity Analysis for K048-K052[1]

Waste code	Type of alternative treatment/recovery	1988 Volume needing alternative capacity (gallons/year)
K048	Combustion of sludges/solids	33,407,730
K048	Stabilization of incinerator ash	3,337,927
K048	Stabilization of scrubber water treatment sludge	334,077
K049	Combustion of sludges/solids	27,727,970
K049	Stabilization of incinerator ash	2,829,885
K049	Stabilization of scrubber water treatment sludge	277,280
K049	Wastewater treatment - carbon adsorption and chromium reduction	902,640
K049	Stabilization of wastewater treatment sludge	9,026
K050	Combustion of sludges/solids	10,369,264
K050	Stabilization of incinerator ash	1,060,953
K050	Stabilization of scrubber water treatment sludge	103,693
K051	Combustion of sludges/solids	70,229,928
K051	Stabilization of incinerator ash	7,041,181
K051	Stabilization of scrubber water treatment sludge	702,299
K052	Combustion of sludges/solids	11,019,426
K052	Stabilization of incinerator ash incineration residues	1,137,362
K052	Stabilization of scrubber water treatment sludge	110,194
	Total	170,600,835

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[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

Most of the petroleum refining waste were reported in the TSDR Survey as sludges (as described above), and therefore, are assigned to combustion of sludges. However, there were some notable exceptions. One facility described their K049 waste stream as a wastewater or an aqueous mixture. From the facility schematic, it was determined that this stream resulted from tank cleaning. The Agency believes this waste would be too low in organic content to be incinerated; instead, this stream was determined to require carbon adsorption, chromium reduction, and chemical precipitation, with stabilization of the wastewater treatment sludge. The carbon adsorption would remove the organics followed by chromium reduction and chemical precipitation to remove the metals from the wastewater stream.

A second case was a K051 waste stream identified by a facility as an aqueous mixture. From the facility schematic it was determined that the waste stream comes from a tank that has only sludge entering it and two streams exiting, one an aqueous stream that is recycled back into the wastewater treatment plant. The stream in question is the only other stream exiting the tank and is then sent to land treatment. This waste stream was therefore determined to be a sludge, and was assigned to sludge incineration.

There were also two cases of facilities reporting K048-K051 as organic liquids. However, the Agency believes that these waste description codes were mistakenly reported by the facility. In one case, the stream is an effluent from a dewatering tank that is sent to land treatment. This type of treatment typically results in generation of a sludge. This volume was therefore assigned to sludge/solid incineration. In the other case, however, the organic liquid first enters a surface impoundment for evaporation before land treatment. Through review of the survey responses, the Agency believes that there is adequate onsite tank storage capacity to sufficiently dewater the waste without continuing to rely on land placement; therefore, only that volume of sludge that is sent to land treatment will require sludge incineration.

Those waste streams described as solids were assigned to solids incineration. In addition to incineration, metals treatment (chromium reduction and chemical precipitation) of the scrubber water followed by stabilization of the resulting wastewater treatment sludge would be required. The incinerator ash would also be stabilized.

At one facility, K048-52 was reported as entering surface impoundments for dewatering (volume reduction). Rather than assuming that the entire volume that enters the surface impoundments requires sludge incineration, only the volume that settles out in the impoundments was determined to require alternative treatment/recovery. The Agency believes that dewatering, which presently occurs in surface impoundments, can be done instead in existing onsite tanks.

Based on the information from the TSDR Survey, the Agency does not believe that adequate alternate capacity exists for K048-52. Therefore, the Agency is proposing to grant a two-year national capacity variance from the ban effective date for K048-52 wastes requiring alternative treatment.

K061

RCRA hazardous waste K061 is described as emission control dust/sludge from the primary production of steel in electric furnaces. K061 is listed as a hazardous waste because of the presence of hexavalent chromium, lead, and cadmium. The Agency has identified the BDAT technology for K061 to be high temperature metals recovery. As shown in Table 3.2.19, all K061 waste identified by the TSDR Survey as requiring alternate treatment was assigned to the BDAT technology.

One waste stream (67,920 gallons) in the TSDR Survey was reported as a mixed K061 and K062 stream. After reviewing the Survey information, it was determined that the waste stream had been received from an offsite facility and was directly landfilled. Because of this information and the characteristics of the waste codes involved, the Agency assumed that the waste stream is an inorganic solid. The Agency believes that these wastes will likely be segregated upon promulgation of the land disposal restrictions, and therefore, will no longer be generated as a mixed waste stream. To conservatively estimate the volumes of K061 and K062 that will require alternative treatment, the entire volume of this waste stream was assigned to the BDAT technologies for both K061 and K062, with no resulting impact on capacity variance determinations for those wastes (see below).

Based on the information from the TSDR Survey, the Agency does not believe that adequate alternative capacity exists for K061. Therefore, the Agency is proposing to grant a two-year national capacity variance from the ban effective date for K061 wastes requiring alternate treatment.

Table 3.2.19 Capacity Analysis For K061[1]

Type of alternative treatment/recovery	1988 Volume needing alternative capacity (gallons/year)
High temperature metals recovery	82,800,488

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[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K062

RCRA hazardous waste K062 is described as spent pickle liquor from steel finishing operations of plants that produce iron and steel. K062 is listed as a hazardous waste because of the presence of hexavalent chromium and lead. The Agency has identified the BDAT technology for K062 to be chromium reduction followed by chemical precipitation and sludge dewatering. As shown in Table 3.2.20, all of the K062 identified by the TSDR Survey as requiring alternate treatment was assigned to this BDAT technology. The BDAT technology identified for K062 waste does not require stabilization of the wastewater treatment sludge.

One waste stream (67,920 gallons) reported in the TSDR Survey was a mixed K061 and K062 stream. After reviewing the survey for this facility, it was determined that the waste stream had been received from offsite and was directly landfilled. Because of this information and the characteristics of the waste codes involved, the Agency assumed the waste stream to be an inorganic solid. The Agency believes that these wastes will likely be segregated upon promulgation of the land disposal restrictions, and therefore, will no longer be generated as a mixed waste stream. In order to conservatively estimate the volumes of K062 and K061 that will require alternative treatment, the entire volume of this waste stream was assigned to the BDAT technologies for both K062 and K061. The K062 waste was assumed to require slurrying prior to chromium reduction, chemical precipitation, and sludge dewatering.

Table 3.2.20 Capacity Analysis For K062[1]

Type of alternative treatment/recovery	1988 Volume needing alternative capacity (gallons/year)
Wastewater treatment: chromium reduction	40,325,050

[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

Based on the information from the TSDR Survey, the Agency believes that adequate capacity is available for chromium reduction and stabilization (if necessary) of K062 wastes. Therefore, the Agency does not propose to grant a capacity variance from the effective date to K062 wastes requiring these technologies.

K071

RCRA hazardous waste K071 is described as brine purification muds from the mercury cell process in chlorine production, where separately prepurified brine is not used. K071 is listed as a hazardous waste because of the presence of mercury. The Agency has identified the BDAT technology for K071 to be acid leaching followed by chemical oxidation, dewatering of sludges and sulfide precipitation of metals in the effluent. The resultant wastewater treatment sludge from the BDAT treatment of K071 is K106. K106 is discussed later in this section. As shown in Table 3.2.21, all of the K071 identified from the TSDR Survey as requiring alternate treatment was assigned to this BDAT technology.

Based on the information in the TSDR Survey, the Agency does not believe that adequate capacity is available for K071 wastes. Therefore, the Agency is proposing to grant a 2-year national capacity variance from the ban effective date to K071 wastes requiring alternate treatment.

Table 3.2.21 Capacity Analysis For K071[1]

Type of alternative treatment/recovery	1988 Volume needing alternative capacity (gallons/year)
Acid leaching, chemical oxidation and dewatering of sludges and sulfide precipitation of metals in effluent	3,886,560

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[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K083

RCRA hazardous waste K083 is described as distillation bottoms from aniline production. K083 is listed as a hazardous waste because of the presence of aniline, diphenylamine, nitrobenzene, and phenylenediamine. The Agency has identified the BDAT technology for K083 to be incineration. The BDAT treatment of K083 does not require treatment of scrubber water and incinerator ash. As shown in Table 3.2.22, all of the K083 identified from the TSDR Survey as requiring alternate treatment was assigned to this BDAT technology. K083 was not reported as being mixed with any metals bearing wastes in the TSDR Survey; therefore, the treatment of scrubber water and incinerator ash for mixed waste streams was not necessary.

Based on information from the TSDR Survey, the Agency believes that adequate incineration capacity exists for K083. Therefore, the Agency does not propose to grant a capacity variance from the ban effective date for K083 wastes requiring alternate treatment.

Table 3.2.22 Capacity Analysis For K083[1]

Type of alternative treatment/recovery	1988 Volume needing alternative capacity (gallons/year)
Combustion of sludges/solids	74,400

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[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K086

RCRA hazardous waste K086 is described as solvent washes and sludges, ink residues, and wastewaters from cleaning tubs and equipment used in the formulation of ink from pigments, driers, soaps, and stabilizers containing chromium and lead. K086 is listed as a hazardous waste because of the presence of lead and hexavalent chromium. BDAT treatment standards have only been set for K086 solvent washes and sludges. The BDAT treatment standards for K086 ink residues and wastewaters have been deferred, and therefore, not included in this analysis. The Agency has identified the BDAT technology for K086 solvent washes and sludges to be incineration, with chromium reduction and chemical precipitation of the scrubber water, and stabilization of the scrubber water treatment sludge and incinerator ash.

As shown in Table 3.2.23, the K086 waste identified from the TSDR Survey as requiring alternative treatment was assigned to this BDAT technology.

Based on the information from the TSDR Survey, the Agency believes that adequate alternate capacity exists for incineration and stabilization of K086 solvent washes and sludges. Therefore, the Agency does not propose to grant a capacity variance from the ban effective date for K086 wastes requiring alternate treatment.

Table 3.2.23 Capacity Analysis For K086[1]

Type of alternative treatment/recovery		1988 Volume needing alternative capacity (gallons/year)
Combustion of liquids		204,828
Combustion of sludges/solids		960
Stabilization of incinerator ash		2,000
Stabilization of scrubber water		2,058
	Total	209,846

[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K087

RCRA hazardous waste K087 is described as decanter tank tar sludge from coking operations. K087 is listed as a hazardous waste because of the presence of phenol and naphthalene. The Agency has identified the BDAT technology for K087 to be incineration with chemical precipitation of the scrubber water and stabilization of the scrubber water treatment sludge and the incinerator ash. As shown in Table 3.2.24, all of the K087 waste identified from the TSDR Survey as requiring alternative treatment was assigned to this BDAT technology.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for K087. Therefore, the Agency does not propose to grant a national capacity variance from the ban effective date for K087 wastes requiring alternate treatment.

Table 3.2.24 Capacity Analysis For K087[1]

Type of alternative treatment/recovery		1988 Volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		1,235,850
Stabilization of incinerator ash		123,585
Stabilization of scrubber water treatment sludge		12,359
	Total	1,371,794

[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K101 and K102

RCRA hazardous wastes K101 and K012 are described as residues from the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds. K101 and K102 are listed as hazardous wastes because of the presence of arsenic. The Agency has identified the BDAT technology for K101 and K102 to be incineration with chemical precipitation of the scrubber water and stabilization of the scrubber water treatment sludge and the incinerator ash. The data used for the capacity analysis of K101 and K102 came from the 1985 Biennial Report data base, not the TSDR Survey. The volumes reported in Table 3.2.25 represent the total volume of K101 and K102 waste generated, rather than the total volume land disposed. Therefore, the volumes represent a "worst case" conservative analysis. As shown in Table 3.2.25, all of the K101 and K102 waste identified were assigned to this BDAT technology.

Based on the information from the 1985 Biennial Report data base, the Agency believes that adequate incineration and stabilization capacity exists for K101 and K102. Therefore, the Agency does not propose to grant a capacity variance from the ban effective date for K101 and K102 wastes requiring alternate treatment.

Table 3.2.25 Capacity Analysis For K101 and K102[1]

Type of alternative treatment/recovery		1988 Volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		95,000
Stabilization of incinerator ash		9,500
Stabilization of scrubber water treatment sludge		950
	Total	105,450

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[1] Baseline volumes data from the 1985 Biennial Report Data Base. Volumes do not include underground injection quantities or contaminated soils.

K103

RCRA hazardous waste K103 is described as process residues from aniline extraction from the production of aniline. K103 is listed as a hazardous waste because of the presence of aniline, nitrobenzene, and phenylenediamine. The Agency has identified the BDAT technology for K103 to be solvent extraction followed by steam stripping, carbon adsorption, and carbon regeneration. This BDAT was identified for liquid K103 waste streams. However, as shown in Table 3.2.26, only K103 sludges/solids were identified from the TSDR Survey as requiring alternative treatment. The Agency believes that incineration of the K103 sludges/solids will meet the BDAT treatment standard.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration capacity exists for K103. Therefore, the Agency does not propose to grant a capacity variance from the ban effective date for K103 wastes requiring alternate treatment.

Table 3.2.26 Capacity Analysis For K103[1]

Type of alternative treatment/recovery	1988 Volume needing alternative capacity (gallons/year)
Combustion of sludges/solids	65,040

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[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K104

RCRA hazardous waste K104 is described as combined wastewater streams generated from nitrobenzene/aniline production. K104 is listed as a hazardous waste because of the presence of aniline, benzene, diphenylamine, nitrobenzene, and phenylenediamine. The Agency has identified the BDAT technology for K104 to be solvent extraction followed by liquid incineration, steam stripping, carbon adsorption, and carbon regeneration. This BDAT technology was identified for K104 as described in 40 CFR 261.32 (wastewater); however, as shown in Table 3.2.27, only K104 sludges/solids were identified from the TSDR Survey as requiring alternative treatment. The Agency believes that incineration of K104 sludges/solids will meet the BDAT treatment standard.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration capacity exists for K104. Therefore, the Agency does not propose to grant a capacity variance from the ban effective date for K104 wastes requiring alternate treatment.

Table 3.2.27 Capacity Analysis For K104[1]

Type of alternative treatment/recovery	1988 Volume needing alternative capacity (gallons/year)
Combustion of sludges/solids	16,320

[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

K106

RCRA hazardous waste K106 is described as wastewater treatment sludge from the mercury cell process in chlorine production. K106 is listed as a hazardous waste because of the presence of mercury. The Agency has identified the BDAT technology for K106 to be mercury retorting. As shown in Table 3.2.28, the K106 waste identified from the TSDR Survey as requiring alternate treatment was assigned to this BDAT technology. K106 waste is also generated in the BDAT treatment of K071 waste. However, the Agency assumes that additional K106 waste will not be generated because adequate capacity does not exist for the BDAT treatment of K071. Therefore, additional volumes of K106 waste which may have been generated are not included in this analysis.

Based on the information from the TSDR Survey, the Agency does not believe that adequate alternate capacity exists for mercury retorting of K106. Therefore, the Agency is proposing to grant a two-year national capacity variance from the ban effective date for K106 wastes requiring alternate treatment.

Table 3.2.28 Capacity Analysis For K106[1]

Type of alternative treatment/recovery	1988 Volume needing alternative capacity (gallons/year)
Metals recovery: mercury retorting	377,520

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[1] Baseline volumes data from TSDR Survey for 1986 (facility responses as of April 11, 1986). Volumes do not include underground injection quantities or contaminated soils.

3.2.5 Non-Solvent RCRA Wastes Containing Halogenated Organic Compounds

Tables 3.2.29 through 3.2.31 present estimates of annual land disposed volumes for non-solvent RCRA wastes which are potential California List wastes containing halogenated organic compounds (HOCs) at concentrations of 1,000 mg/kg or greater. Separate tables are presented for total HOC wastes, HOC wastes that are also First Third proposed wastes, and all other HOC wastes. The same procedures used for tabulating all RCRA wastes apply to HOC volumes. However, the total volume for each management practice in Tables 3.2.29 through 3.2.31 represents the sum of all single, HOC waste streams (in that table's regulatory group) and all waste groups containing at least one potential HOC (in that table's regulatory group) but containing no solvents.

The volume of land disposed HOC wastes requiring alternative commercial treatment capacity will be somewhat less. The facility level treatability and capacity analyses conducted on the HOC wastes being land disposed determined that 3 million gallons of these wastes either were lab pack wastes (approximately 48,000 gallons) or could be treated onsite, and therefore, were not included in the volume requiring alternative commercial treatment capacity. Based on this, the Agency estimates that 9 million gallons of HOC wastes will require alternative treatment capacity on a commercial basis. This volume includes 5 million gallons of soil which are included in a separate section of this document; therefore it is estimated that only 4 million gallons of non-soil HOC wastes will require alternative commercial treatment capacity.

Table 3.2.29 Overview of Potential California List Wastes Containing Halogenated Organic Compounds

	Land disposed volume[1] (million gallons/year)
Storage only	
- Waste piles	<1
- Surface impoundments	<1
Treatment	
- Waste piles	7
- Surface impoundments	1
Disposal	
- Landfills	18
- Land treatment	<1
- Surface impoundments	<1
Total	26

[1] Baseline was TSDR Survey data for 1986 (facility responses as of April 11, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment impoundments retrofit to meet minimum technology requirements.

Table 3.2.30 Overview of Proposed First Third Wastes Containing Halogenated Organic Compounds

	Land disposed volume[1] (million gallons/year)
Storage only	
- Waste piles	<1
- Surface impoundments	<1
Treatment	
- Waste piles	7
- Surface impoundments	<1
Disposal	
- Landfills	7
- Land treatment	<1
- Surface impoundments	<1
Total	14

[1] Baseline was TSDR Survey data for 1986 (facility responses as of April 11, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment impoundments retrofit to meet minimum technology requirements.

Table 3.2.31 Overview of All Other Wastes Containing Halogenated Organic Compounds

	Land disposed volume[1] (million gallons/year)
Storage only	
- Waste piles	<1
- Surface impoundments	<1
Treatment	
- Waste piles	<1
- Surface impoundments	1
Disposal	
- Landfills	11
- Land treatment	<1
- Surface impoundments	<1
Total	12

[1] Baseline was TSDR Survey data for 1986 (facility responses as of April 11, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment standards retrofit to meet minimum technology requirements.

Table 3.2.32 presents the results of capacity analysis for HOC containing wastes (not including underground injection waste volumes). Similarly, to eliminate double-counting, this table does not include either wastes that are considered (or contain) First Third proposed wastes or solvents.

Based on the data from the TSDR Survey, the Agency has determined that adequate capacity exists for the volume of HOC wastes requiring combustion. Consequently, the Agency is today proposing a recission of the national capacity variance previously granted to these wastes.

3.2.5 Contaminated Soils

Due to the unique treatability and regulatory issues associated with contaminated soils, they have been handled separately in this document. Table 3.2.33 presents estimates based on TSDR Survey data of the total volume of contaminated soils land disposed at Subtitle C facilities and a breakdown of the total volume land disposed per regulatory group affected by today's proposal. Contaminated soils were identified by the waste description code associated with each waste stream, and do not include contaminated debris unless specifically stated by the facility. The survey does not contain data on the volume of soils generated, only volumes land disposed. Furthermore, no data is available on the source generating the waste volume being land disposed (e.g., corrective actions, spill clean-ups, etc.)

Available capacity was first assigned to the non-soil land disposed wastes analyzed in this document (i.e., solvent, First Third proposed,

Table 3.2.32 Capacity Analysis for HOC Wastes
(excluding First Third Proposed HOCs)

Technology	Available capacity (million gal/yr)	Required capacity (million gal/yr)
Combustion		
- Liquids	246	<1
- Sludges/solids	4	2
Wastewater treatment (for organics)	~~73~~ 74	2

Table 3.2.33 Volume of Contaminated Soil
Waste Volumes Land Disposed

Regulatory group	Land disposed volume (million gallons/year)
Solvents	25
First third (proposed) wastes	18
First third (not proposed) wastes containing HOCs	2
All other HOC wastes	4
Other RCRA wastes	5
All RCRA wastes	54

and HOCs). The remaining capacity was then used as available for contaminated soils. Table 3.2.34 presents the results of the capacity analyses conducted for soils contaminated with solvents, First Third proposed, and HOC wastes (excluding First Third proposed wastes containing HOCs).

The results show that adequate capacity exists for the volume of contaminated soils requiring stabilization (i.e., soils contaminated with metal bearing wastes). However, capacity is not adequate for the volume of soils requiring combustion (i.e., soils contaminated with organics). Therefore, the Agency is proposing to grant a two-year national capacity variance for contaminated soils requiring combustion.

In addition, approximately one million gallons of contaminated soils was identified in the TSDR Survey as K061. This waste was therefore assigned to high temperature metals recovery, the BDAT for K061. The Agency does not believe however that high temperature metals recovery is an appropriate technology for contaminated soils. However, as mentioned in today's preamble, the Agency is investigating whether it is appropriate to establish a separate treatability subcategorization for these wastes. Furthermore, the rules contain a treatability variance which allows a petitioner to demonstrate that his waste cannot be treated to the specified level (see 40 CFR Part 268.44).

Table 3.2.34 Contaminated Soils
Capacity Analysis

Technology	Available capacity (million gal/yr)	Required capacity (million gal/yr)
Combustion (sludges/solids) of soils		
- Solvents		25
- First Third proposed	2	11
- HOCs (excluding above)		4
Stabilization of soils contaminated with:		
- Solvents		<1
- First Third proposed (combustion residues)	>282	2
- First Third proposed (other)		6
High temperature metals contaminated with:		
- First Third proposed	0	1

4.0 CAPACITY ANALYSIS METHODOLOGY

This section of the background document presents a detailed discussion of the methodology (approach) and rationale for the capacity analyses to support this proposed rule.

Section 4.1, Data Set Generation, includes a brief discussion of the data sources and the technical review and quality control procedures associated with the creation of the new waste volume data set used for capacity analysis. Section 4.1 presents a detailed discussion of the methodology used for determination of required alternative capacity for land disposed wastes (capacity demand). Section 4.2 presents a detailed discussion on the determination of available alternative capacity (supply) and the creation of the alternative capacity data sets used for the analysis. Finally, Section 4.3 presents the methodology and the results for the comparative analysis of waste volumes and the associated demand for the alternative capacity against the supply of available capacity, to determine if adequate capacity exists to support the land disposal restrictions.

4.1 Determination of Required Treatment Capacity

This section presents a detailed discussion of the analytical methodology used to determine the demand for alternative treatment capacity required by wastes affected by today's proposed rule.

4.1.1 Waste Volumes Affected

As mentioned previously, this document presents an analysis of required and available treatment capacity for solvent wastes, HOC wastes, and First Third proposed wastes, including contaminated soils. To assess the requirements for alternative treatment capacity that will result from the restrictions, it was necessary to identify waste volumes by land disposal method, waste code, and physical/chemical form. With this information, it is possible to identify which treatment technologies are applicable to the waste volumes and to determine required alternative treatment capacity.

(1) Data Sources. The TSDR Survey data base described above was the primary source used to estimate waste volumes. The 1985 Biennial Report data base was used to estimate waste volumes for K101 and K102 wastes as well as waste volumes at one large commercial landfill that did not provide data in the TSDR Survey.

(2) Identification of Waste Volumes. Only solvent, First Third proposed, and HOC wastes have been included in this document. These wastes were identified on a waste code basis. For solvent or First Third proposed wastes described by a single waste code, the volume was allocated to the appropriate regulatory group (i.e., solvents or First Third proposed).

For waste groups (mixed wastes and/or wastes described by more than one RCRA waste code), the entire volume was included in the regulatory group of the highest priority code in the group. For example, if a waste group was described by both a solvent waste code (F001-F005) and a First Third proposed code, the entire waste volume was assigned to solvents because they were restricted prior to First Third proposed wastes.

The solvent wastes include the following spent solvent waste stream: F001, F002, F003, F004, and F005.

The First Third proposed wastes include those wastes identified in Table 2.2.1. However, not all First Third proposed wastes have been included in the analysis of required treatment capacity. For some of the First Third proposed wastes, a treatment standard of "No Land Disposal" is being proposed because EPA has determined that these wastes are not currently generated or that they can be totally recycled. A "No Land Disposal" standard is being proposed for K004, K008, K021, K025, K036, K060, K073, and K100 because EPA has determined that these wastes are no longer generated. Similarly, the Agency is proposing a "No Land Disposal" standard for K069 waste because it is totally recycled and therefore no longer land disposed. EPA is also proposing a standard of no land disposal for K044, K045, and K047 wastes because open burning and open detonation of reactive wastes is not considered to be land disposal.

Although the TSDR Survey contains data showing that some of the wastes discussed above were land disposed in 1986, the Agency is excluding these wastes from the analysis of required capacity for First Third proposed wastes on the basis of more recent data obtained by EPA's BDAT Program.

HOC wastes were also identified on a waste code basis. Any waste described by a waste code listed in 40 CFR Part 261 for containing a halogenated organic (except F001-F005 solvent wastes) was conservatively assumed to be a potential California List HOC waste (i.e., contains $\geq$1,000 ppm HOCs). HOC wastes were identified as either "HOCs and First Third proposed," or "all other HOCs." However, because HOC wastes that are also First Third proposed wastes and HOC waste groups that also contain a First Third Proposed waste have already been included under the capacity analysis for First Third proposed wastes, they have been excluded from the capacity analysis for HOC wastes.

(3) Determination of Affected Volumes. Solvent, First Third proposed, and HOC land disposed wastes are affected by the restrictions and will require alternative treatment capacity. Land disposal is defined under RCRA as any placement of hazardous waste into or on the land. Therefore, storage and treatment of hazardous waste in or on the land is also considered land disposal. Land disposal methods can be divided into numerous categories. Four of these methods are addressed in detail in this document: disposal in landfills; treatment and storage in waste piles; disposal by land application; and treatment, storage, and disposal in surface impoundments. Utilization of salt dome formations, salt bed formations, and underground mines and caves are additional methods of land disposal that are affected by this rulemaking. Currently, there is insufficient information to document the volumes of First Third wastes disposed of by these last three methods; therefore, they are not addressed in the analysis of volumes and required alternative treatment capacity. Underground (deepwell) injection, another form of land disposal, will be covered under a separate

rulemaking; thus, the volume of underground injected wastes has not been included in this document.

Estimates of the volume of affected wastes that have been stored (but not treated or disposed of) in surface impoundments or waste piles are presented. Storage implies a temporary placement of wastes in the surface impoundment or waste pile. EPA has assumed that all of the affected wastes stored in surface impoundments are eventually treated or recycled or that they are routed to permanent disposal in other existing units. To avoid double-counting in this analysis (i.e., counting waste volumes once when they are stored and again when they are finally disposed of), the volumes of wastes reported as being stored in surface impoundments or waste piles were not included in the estimates of volumes requiring alternative treatment capacity. Nevertheless, these wastes will be affected by the restrictions and will require alternative storage capacity. However, if it were determined during the facility level analysis that wastes were being stored indefinitely in the impoundment or waste pile (i.e., long term storage), these volumes were included as requiring alternative treatment capacity because they would not be counted elsewhere. Long term storage of hazardous waste was determined by examining the responses to the TSDR Survey regarding waste piles and surface impoundments. If hazardous waste entered the waste pile or surface impoundment for storage in 1986 but was not reported as having been removed from the impoundment or waste pile for treatment or disposal previous to or during 1986, the waste was considered to have undergone long term storage.

HSWA requires that all surface impoundments must be in compliance with certain minimum design and operating criteria (see RCRA Section 3005(j)(11)(A) and (B)) to continue operating beyond November 8, 1988. Furthermore, the land disposal restrictions, upon promulgation, forbid placement of restricted wastes in surface impoundments, except for treatment. These treatment impoundments, however, must meet the minimum technology standards mentioned above. Consequently, most surface impoundments will either be replaced by tanks, retrofit to meet the minimum technical standards, or closed entirely by 1988. Because the baseline year for the TSDR Survey is 1986, however, the 1986 land disposed volumes do not reflect these changes. Therefore, a special analysis of the management of wastes in surface impoundments was conducted. As described in Section 3.1.1, if it could be determined from the survey responses or through facility followup that a treatment surface impoundment was being closed without a replacement (i.e., the surface impoundment will be bypassed because it is not crucial to effective operation of the treatment system), replaced by tanks, or being retrofit, then the volume was dropped from further analysis of waste requiring alternative treatment capacity.

For surface impoundments used for treatment and long term storage or for treatment and disposal that were being replaced by tanks or retrofit, it was sometimes necessary to include the volume of treatment residual generated in the impoundment in 1986 in the volume requiring alternative treatment capacity. Because the impoundment was used for long term storage or disposal of the treatment residual, the volume was not counted elsewhere as land disposal. Assuming that the treatment residual would continue to be generated after retrofit or replacement, the volume of treatment residual generated on an annual basis, not the entire volume entering the impoundment for treatment, was included as requiring alternative treatment capacity. For example, if a facility reported that in 1986 it used a surface impoundment for treatment (settling) and disposal of a First Third proposed hazardous waste but in 1988 it was replacing the impoundment with a settling tank, the volume of waste entering the impoundment in 1986 would not require alternative treatment capacity because it would no longer be land disposed in 1988. However, the volume that was settling for disposal in 1986 would still be generated in the tank (clarifier) in 1988 and therefore would require alternative treatment capacity prior to disposal. The treatment residual volume would therefore be included in the volume of wastes requiring alternative treatment capacity. If, however, it was determined that the impoundment was a flow-through impoundment and only incidental settling occurred (i.e., less than one percent of the volume entering was settled), then it was assumed that there would be essentially no settling when replaced by a tank.

4.1.2 Treatability Analysis

Those wastes that will require alternative treatment/recovery because of the land disposal restrictions have been identified and must be analyzed to determine the types of alternative treatment required. This process is referred to as treatability analysis.

This section discusses the methodology used to perform treatability analyses on the wastes identified as requiring alternative treatment/recovery.

(1) Waste characterization. Respondents to the TSDR Survey were asked to provide limited waste characterization, including a waste code(s) and a waste description code (A/B codes), for each waste stream being land disposed. The A/B codes classify wastes by the following general categories and also provide limited qualitative information on hazardous constituents in the waste: inorganic liquids, sludge, solids and gases and organic liquids, sludges, solids, and gases. The waste code and A/B codes combinations were the primary source of characterization data used to assess treatability of the wastes.

A limited number of facilities, however, did not provide these codes. If during technical review of the survey or facility followup, the facility was either unwilling or unable to provide these codes, engineering judgment was used to assign a waste description code. All available information from the survey was used to assign the waste description codes, including the survey responses and the facility schematic. These sources could provide information on previous management (e.g., was the waste a treatment residual) and the origin of the waste (e.g., mixture ruled and derived from the rule wastes) and how the waste was being land disposed.

In addition, for F and K coded wastes for which the facility did not provide waste description codes, the waste description in 40 CFR Part 260, as well as information contained in a report characterizing these wastes (Ref. 7), was used to assign the waste to the most common physical/chemical form. Occasionally, it was not feasible to assign the waste to the most common form. For example, if the available information indicated the waste was commonly a solid but the waste was being underground injected, it was assumed to be a liquid rather than a solid.

P and U coded wastes for which the facility did not provide waste description codes were generally assigned to either off-spec or discarded products, contaminated solids, or aqueous clean-up residue, depending on the volume, management, and assumed physical form of each waste. Again, any assumptions regarding the physical form were based on any available information from the schematic or survey, including the methods of management. For example, landfilled wastes were assumed to be either sludges or solids, and underground injected wastes were assumed to be liquids. If the volume of waste without description being land disposed was large, i.e., greater than 50 tons of solids and 1,000 gallons for liquids, the waste was assumed to be a contaminated soil or aqueous waste derived from clean-up residue. This was based on the assumption that, for economic reasons, only small volumes of off-spec products are likely to be produced, and therefore only small volumes would be land disposed.

Characteristic, or D coded wastes for which the facility did not provide waste description codes were generally assigned a waste description based on the type of land disposal, any information from the schematic or other survey responses, and the characteristic represented by the particular D-code. For example, pesticides wastes characteristically hazardous for toxicity were generally considered organic, while toxic metal wastes were considered inorganic.

(2) Treatability grouping. As previously mentioned, EPA is required to establish treatment standards for those wastes being restricted from land disposal. The Agency has the option to specify the use of a particular technology or can set a concentration standard based on the performance of the best demonstrated available technology (BDAT). For solvent and First Third proposed wastes, the Agency has generally established concentration standards based on BDAT; however, EPA has established that non-wastewater HOCs require incineration (including industrial kilns).

Using the characterization data provided by the survey, the waste code and A/B code combinations, and considering the BDAT technologies identified by EPA, wastes were assessed for treatability and assigned into treatability groups. These treatability groups were then assigned to BDAT treatment, or in some cases alternative treatment, that the Agency believes are capable of meeting the BDAT treatment standard. For example, if the BDAT technology was identified as rotary kiln incineration, it was assumed that other types of incineration with the appropriate feed system would be able to achieve the BDAT standard. In addition for this analysis, reuse as fuel in an industrial kiln was also assumed to be equivalent to incineration.

Wastes with similar A/B codes that require the same BDAT were assigned to the same treatability groups. Appendix D shows the treatability groups to which the various waste code and A/B code combinations were assigned. Appendix E presents the alternative treatment/recovery technologies associated with each treatability group, and Appendix F contains a description of each alternative treatment/recovery technology.

(3) Alternative technologies. In limited cases, waste could not be assigned to the treatability group representing the BDAT treatment, because the physical/chemical form of the waste was incompatible with the BDAT treatment. In these cases, an engineering analysis of the waste stream was conducted in order to assign the waste to an alternative technology believed capable of achieving the BDAT treatment standard. The results of these analyses for each waste stream are presented in the waste code-by-waste code discussions in Section 3.2.1(3). The TSDR Survey does not contain data on the performance of treatment technologies; therefore several alternatives sources (Refs. 8, 9, 10, 11, 12) and "best engineering judgment" were required to identify potential alternatives to BDAT.

A similar analysis was conducted for waste groups (i.e., mixed wastes). Waste groups are hazardous wastes that are described by more than one RCRA Waste Code, and present special treatability problems in that they are often contaminated with hazardous constituents which may fall under more than one treatability group (e.g., organics and metals). Such waste groups can generally not be assigned only to the BDAT technology for one specific waste type. Instead, a treatment train must be developed which is capable of treating each waste type in the group sequentially. Often these treatment trains can be developed by combining BDAT treatments in sequence, or by adding pre- or post-treatment steps to the BDAT technology. Treatment trains were developed using the references mentioned above and engineering judgment.

(4) Treatment residuals. Treatment technologies generate residuals which create capacity demand. For example, K048 wastes require sludge incineration followed by stabilization of the incinerator ash and chromium reduction and chemical precipitation of the scrubber water followed by stabilization of the resultant wastewater treatment sludge. Based on the TSDR Survey responses, it was determined that RCRA permitted incinerators have adequate air pollution control devices (APCD) (including scrubber water treatment at those facilities with wet scrubbers) and that the facility considered the capacity of the APCD when determining the capacity of their incinerator, therefore no attempt was made to evaluate capacity for treatment of scrubber waters. Wastewater

treatment sludges requiring stabilization, however, were included in the estimate of treatment residuals requiring capacity. Consequently, in the example used above, the K048 waste stream would require incineration and stabilization capacity.

Although the entire volume would require incineration, only a portion of the original volume would require stabilization because the amount of ash and wastewater treatment sludge generated would be less than the original volume incinerated. To account for these changes in the volume within a treatment train, volume adjustment factors were developed. These factors were developed using engineering judgment and are dependent on the type of treatment and the physical/chemical form of the waste. The factor represents that percent of the original volume exiting the technology of concern. In the example used above, K048 is an organic sludge being incinerated. The volume adjustment factor used to estimate the volume of ash generated from incineration of an organic sludge is 0.1, or 10 percent of the original volume, and the volume of wastewater treatment sludge is estimated at 0.01 or 1 percent of the original volume. Therefore, if 100 gallons were incinerated, the volume adjustment factor would estimate that 10 gallons of ash and one gallon of wastewater treatment sludge would be produced.

(5) Previous management. Another important factor considered during the treatability analysis of a waste was any previous management. Using information contained in the TSDR Surveys and the facility schematics, it

was possible to evaluate the previous management, if any, for wastes being land disposed. Whenever possible, the previous management of land disposed wastes was evaluated in an attempt to determine if the waste had already been treated by the BDAT technology or a technology believed capable of achieving the BDAT treatment standard. If it could be determined that the waste had been previously treated by such a technology, the waste was assumed to meet the BDAT treatment standard. Such wastes would therefore not be prohibited from land disposal and were consequently not included if further analysis of the volume of wastes requiring alternative treatment/recovery capacity.

(6) Wastes excluded from further analysis. Similarly, because of the unique treatability issues associated with lab packs, these wastes were not included in the volume of wastes requiring alternative treatment/recovery capacity. Furthermore, these volumes represent only a small portion of the volume of wastes affected by today's proposal. Less than 75,000 gallons of solvent, First Third Proposed, or HOC lab pack wastes were reported as land disposed in the TSDR Survey.

4.2 Determination of Available Treatment Capacity

This section presents a detailed discussion of the analytical methodology used to determine the estimates of alternative "combustion" and "other treatment/recovery" capacity available for wastes affected by today's proposed rule. These processes include combustion in incinerators or industrial kilns, solidification/stabilization, solvent and liquid organic recovery for reuse, metals recovery, acid leaching of sludges, neutralization, and wastewater treatment for cyanides, metals and organics. A discussion of combustion capacity is separate from the discussion of other treatment capacity. Combustion is predominately a single unit process system; therefore, the combustion system analysis does not require locating and quantifying a limiting unit within a treatment train of unit processes as in the analysis of other treatment systems.

4.2.1 Determination of Combustion Capacity

(1) Introduction. The combustion data set was established to determine the following data elements for incineration and reuse as fuel: (1) the utilized capacity during the base or reference year of 1986; (2) the maximum capacity during 1986 and any planned changes through 1990, (3) the unused or available capacity during the periods 1986, 1987, 1988, and 1989-1990; and (4) the possible interchange of capacity between the various hazardous waste forms (feed capabilities) for these time periods should excess capacity exist for certain forms and shortfalls exist for others. The data set was generated by technical review and engineering evaluation of the survey responses, transfer of data to computer entry data sheets, and eventual data consolidation and aggregation to arrive at national totals.

At this time, only commercial facility capacity data are included in the data set, this represents the most readily available capacity, on a national level, to treat the waste that is currently being considered under the land disposal restrictions rule. Due to time constraints, the capacity indicated by the commercial data set does not include information on two other potential categories of waste treatment capacity, limited commercial and captive facility capacity. "Limited commercial" facilities are those that accept wastes from only a limited number of facilities not under the same ownership, in many cases, only from their customers and/or clients. "Captive facilities" are those that treat wastes from other facilities under the same ownership. Data are not yet available to include this analysis. However, the Agency does not believe that a significant amount of available capacity will result from these sources.

The capacity data set was compared to estimates of waste volumes currently being land disposed that will require combustion capacity, to determine if there is adequate incineration and reuse as fuel capacity for all waste forms. Combustion technologies lend themselves well to wastes that are difficult to treat by conventional treatment technologies, and are very versatile in that they can treat the various waste forms (liquids, solids, sludges, and gases) with some interchangeability.

(2) Approach and Methodology. The data set was generated by review and engineering evaluation of TSDR Survey responses, transfer of data in the questionnaires to computer data entry sheets, and final consolidation of all facility capacities to arrive at national totals.

The questionnaires pertaining to incineration and reuse as fuel in the National Survey of Hazardous Waste Treatment, Storage, Disposal and Recycling Facilities (TSDR Survey) were Questionnaire B, "Incineration", and Questionnarie C, "Reuse as Fuel", respectively. A copy of the two questionnaires can be found in the docket for this proposed rule. The questionnaires were designed not only to provide actual utilization and maximum capacity data by the facility, but also other design and operational information to allow the reviewer to evaluate the accuracy of the facility responses. These other data elements were:

- operating/downtime information,
- percent utilization,
- maximum practical thermal rating,
- average heating value of the hazardous and nonhazardous waste being treated,
- maximum practical feed rate for each waste form,
- planned capacity increases/decreases by time period,
- type of solids that can be fed to the unit, and
- waste characteristics that exclude or limit acceptance for treatment.

The above information was used by the reviewer, using heat balances and other methods, to evaluate the validity of the facility responses to utilized and maximum capacity questions and to determine if additional maximum capacity was available over and above what the facility reported. If additional capacity was apparent, the reviewer would make facility contact by telephone to verify his or her findings, and, if agreeable to the facility, adjust the data.

In addition, technical review of reported capacity data included the evaluation of incinerator or kiln support systems such as waste feed handling systems, air pollution control devices, scrubber water treatment systems, and ash handling systems.

The types of incinerators considered in the TSDR Survey were as follows:

- liquid injection
- rotary (or rocking) kiln
- rotary kiln with liquid injection
- two stage
- fixed hearth
- multiple hearth
- fluidized bed
- infra-red
- fume/vapor
- pyrolytic destructor
- other (specify)

The types of units that were considered in the Reuse as Fuel questionnaire were as follows:

- cement kiln
- aggregate kiln
- asphalt kiln
- other kiln (specify)
- blast furnace
- sulfur recovery furnace
- smelting, melting, or refining furnace
- coke oven
- other furnace (specify)
- industrial boiler
- utility boiler
- process heater
- other reuse as fuel (specify)

The computer data sheets used to gather capacity data from Questionnaire "B" and "C" included the following information (brief explanation of each data element):

1. Facility ID - The USEPA identification number for the facility.

2. Facility Name

3. Unit No. - data was gathered on a unit basis since some facilities have more than one incinerator or kiln

4. Commercial status - the two commercial categories are (1) commercial - accepts waste from the general public and (2) accepts waste from a limited number of facilities not under the same ownership

5. Unit type - a code for the type of incinerator, kiln, industrial furnace, or boiler as described earlier

6. Fixed or Mobile unit (F/M)

7. Exempt (Y/N) - RCRA permit status

8. Thermal Rating, MBtu/hr

9. Waste Feed Mix (Y/N)

   (a) liquid
   (b) sludge
   (c) solids
   (d) gases

10. Unique (Y/N): If yes, explain ________________________.

11. Capacity 1986

   A. Hazardous Waste Quantity - this amount represents the quantity of RCRA Hazardous waste treated in the subject unit during calendar year 1986. This quantity is also referred to as utilized capacity.

   B. Non-hazardous Waste Quantity - this is the quantity of non-hazardous waste that was treated in the same unit, either concurrently or separately, during 1986.

   C. Hazardous Waste - Maximum Capacity Quantity - the maximum capacity of hazardous waste that the treatment unit could have treated during 1986.

   D. All Waste - Maximum Capacity Quantity - the maximum capacity of both hazardous and non-hazardous waste that could have been treated in 1986.

The above data were used to manually tabulate and develop the combustion capacity data set, the results of which will be discussed in Section 4.2.3, Development of the Treatment Capacity Data Set and Results.

The data are compiled in a personal computer data base, for more convenient data management. A copy of the PC data sheets along with a description of their use may be found in (Ref. 13).

In order to determine flexability in the proportion of waste capacity by physical form, and whether early start-ups of planned units had occurred, several facilities were contacted. The results of the telephone contact indicated that one rotary kiln with liquid injection unit planned for 1989 has already started up and is operational. The national capacity estimates for 1988 were prepared by using the capacity from this new unit and assessing the potential for varying capacity to manage several physical forms at rotary kilns with liquid injection.

To make the necessary comparisons for this analysis, it was required to convert the original facility responses to one standard unit, that being volume in gallons. Data reported in short tons (2,000 lb/ton) by the facility were consistently converted to gallons by using a conversion factor of 240 gallons/ton (based on the density of water) for all waste forms other than gases. Gases are reported in standard cubic feet (SCF) in the initial data and were converted to tons by assuming an average molecular weight of 29. However, the analyses were done in the appropriate units (e.g., tons for solids), and simply converted to gallons for consistant presentation of units.

Data through 1990 are presented because the long-range plans of many facilities extend to these latter years, and projections of future capacity may be necessary for variance determinations. It is also assumed that the unit installations reported as operational in 1986 with no closure dates reported will continue to operate through 1990.

Although the TSDR Survey has been in progress for about nine months, there are some facilities (about 10 percent) that have not yet returned their completed survey as of April 11, 1988. Among these, there could be a few facilities which operate or plan to operate commercial incinerators or kilns. This fact is especially applicable to facilities with cement kilns, many of which were identified after the initial mailout and thus received the survey late. Cement kilns are rapidly expanding into the hazardous waste management industry because of favorable economic factors. The cement kilns burn primarily hazardous waste organic liquids such as waste solvents and waste oils. However, a small number of these kilns are considering possibly accepting limited amounts of sludges and solids. Thus the capacities of these late kilns will not have a significant affect on today's proposed rule because the available capacity for liquid combustion is already greater than the required and the available capacity for sludges/solids from the late kilns is expected to be small.

Since April 11, 1988, was the cutoff date for data for the analysis to support this proposed rule, the data set may be an underestimate of available combustion capacity at this time because of these late facilities. The Agency is making every effort to encourage these facilities to participate in a timely fashion in the survey. The data set will be updated as these late facilities return their surveys.

4.2.2 Determination of Other Treatment System Capacities

The capacity data set also includes data on treatment systems other than combustion that may be able to treat solvents, First Third wastes, and California List wastes down to their respective treatment standards. These technologies include solidification/stabilization, solvent and liquid organic recovery for reuse, metals recovery, and wastewater treatment processes. Because the TSDR Survey data for these treatment processes are reported on a unit process basis, a method was developed to derive a system capacity from the unit process data. The results of this analysis were aggregated into a hazardous waste treatment system capacity data base (PC-based) for comparison with required capacity.

(1) Unit Process Capacity. The TSDR Survey obtained capacity data on a process specific basis. A process is defined in the TSDR Survey as one or more units of equipment acting together to perform a single operation on a waste stream. A system is defined in the TSDR Survey as one or more processes that work together to treat a waste stream. Figure 4.2.1 presents the process codes provided for the TSDR Survey respondent to report his treatment process information.

During technical review, three different interpretations of the process capacity questions were identified which determined the method of system capacity analysis that had to be employed.

Case I: Each unit process was reported separately. In such case, process units must be agglomerated into treatment systems so that the capacity of the systems may be calculated from the reported maximum and utilized process capacities.

Case II: The same process was conducted in several different units (tanks or surface impoundments) which are found in different systems. The capacity of each unit process was combined and reported as one process by the facility. Responses to the tank and/or surface impoundment questionnaires were used to obtain the utilized capacity of each tank and/or surface impoundment using the process of concern. The maximum capacity of these tanks and/or surface impoundments was obtained by facility contact. The unit process data were then agglomerated into treatment systems as in Case I.

Case III Survey respondent reported the entire treatment system as one process. The utilized and maximum capacities reported for the process were used to represent the entire system. If the individual unit processes that make up the treatment system could not be identified by examining the facility schematic and responses to other questions in the survey, the facility was contacted to obtain that information. The respondent's system data were then inputted into the capacity data set.

Upon completion of technical review the following information was obtained and examined prior to use in the system capacity analysis:

- All processes that comprise the system and the units in which they occur were identified and a flow diagram constructed;
- The amount of hazardous and nonhazardous waste that enter and leave the system was quantified such that a mass balance around the system could be conducted;
- The utilized and maximum capacities of each unit was determined;
- If surface impoundments were used in the treatment system, it was determined whether they met minimum technological requirements. The effect of closing, retrofitting, or replacing the surface impoundment with a tank or new minimum technological surface impoundment on system capacity was determined.
- Also noted were any other planned changes to the system and how it may affect the maximum capacity of the unit and/or system.

Figure 4.2.1

PROCESS CODES

These process codes were developed specifically for this survey to describe the onsite hazardous waste management operations at a facility.

TREATMENT AND RECYCLING

Incineration/thermal treatment

1I	Liquid injection
2I	Rotary (or rocking) kiln
3I	Rotary kiln with a liquid injection unit
4I	Two stage
5I	Fixed hearth
6I	Multiple hearth
7I	Fluidized bed
8I	Infra-red
9I	Fume/vapor
10I	Pyrolytic destructor
11I	Other incineration/thermal treatment

Reuse as fuel

1RF	Cement kiln
2RF	Aggregate kiln
3RF	Asphalt kiln
4RF	Other kiln
5RF	Blast furnace
6RF	Sulfur recovery furnace
7RF	Smelting, melting, or refining furnace
8RF	Coke oven
9RF	Other industrial furnace
10RF	Industrial boiler
11RF	Utility boiler
12RF	Process heater
13RF	Other reuse as fuel unit

Fuel blending

1FB	Fuel blending

Solidification

1S	Cement or cement/silicate processes
2S	Pozzolanic processes
3S	Asphaltic processes
4S	Thermoplastic techniques
5S	Organic polymer techniques
6S	Jacketing (macro-encapsulation)
7S	Other solidification

Recovery of solvents and liquid organics for reuse

1SR	Fractionation
2SR	Batch still distillation
3SR	Solvent extraction
4SR	Thin-film evaporation
5SR	Filtration
6SR	Phase separation
7SR	Dessication
8SR	Other solvent recovery (including pretreatment)

Recovery of metals for reuse

1MR	Electrolytic
2MR	Ion exchange
3MR	Reverse osmosis
4MR	Solvent extraction
5MR	Secondary smelting
6MR	Liming
7MR	Evaporation
8MR	Filtration
9MR	Sodium borohydride
10MR	Other metals recovery (including pretreatment)

Wastewater treatment

Equalization

1WT	Equalization

Cyanide oxidation

2WT	Alkaline chlorination
3WT	Ozone
4WT	Electrochemical
5WT	Other cyanide oxidation

General oxidation (including disinfection)

6WT	Chlorination
7WT	Ozonation
8WT	UV radiation
9WT	Other general oxidation

Chemical precipitation

10WT	Lime
11WT	Sodium hydroxide
12WT	Soda ash
13WT	Sulfide
14WT	Other chemical precipitation

Chromium reduction

15WT	Sodium bisulfite
16WT	Sulfur dioxide
17WT	Ferrous sulfate
18WT	Other chromium reduction

Complexed metals treatment (other than chemical precipitation by pH adjustment)

19WT	Complexed metals treatment

Emulsion breaking

20WT	Thermal
21WT	Chemical
22WT	Other emulsion breaking

Adsorption

23WT	Carbon adsorption
24WT	Ion exchange
25WT	Resin adsorption
26WT	Other adsorption

Stripping

27WT	Air stripping
28WT	Steam stripping
29WT	Other stripping

Evaporation

30WT	Thermal
31WT	Solar
32WT	Vapor recompression
33WT	Other evaporation

Filtration

34WT	Diatomaceous earth
35WT	Sand
36WT	Multimedia
37WT	Other filtration

Sludge dewatering

38WT	Gravity thickening
39WT	Vacuum filtration
40WT	Pressure filtration (belt, plate and frame, or leaf)
41WT	Centrifuge
42WT	Other sludge dewatering

Air flotation

43WT	Dissolved air flotation
44WT	Partial aeration
45WT	Air dispersion
46WT	Other air flotation

Oil skimming

47WT	Gravity separation
48WT	Coalescing plate separation
49WT	Other oil skimming

Other liquid phase separation

50WT	Decanting
51WT	Other liquid phase separation

Biological treatment

52WT	Activated sludge
53WT	Fixed film—trickling filter
54WT	Fixed film—rotating contactor
55WT	Lagoon or basin, aerated
56WT	Lagoon, facultative
57WT	Anaerobic
58WT	Other biological treatment

Other wastewater treatment

59WT	Wet air oxidation
60WT	Neutralization
61WT	Nitrification
62WT	Denitrification
63WT	Flocculation and/or coagulation
64WT	Settling (clarification)
65WT	Reverse osmosis
66WT	Other wastewater treatment

OTHER PROCESSES (TREATMENT OR RECOVERY)

1TR	Other treatment
2TR	Other recovery for reuse

ACCUMULATION

1A	Containers
2A	Tanks

STORAGE

1ST	Container (i.e., barrel, drum)
2ST	Tank
3ST	Waste piles
4ST	Surface impoundment
5ST	Other storage

DISPOSAL

1D	Landfill
2D	Land treatment
3D	Surface impoundment (to be closed as a landfill)
4D	Underground injection well

(2) Hazardous Waste Treatment/Recovery System Identification. Using the facility flow diagram with revisions made as a result of technical review, hazardous waste treatment/recovery systems and their respective unit processes were identified. For purposes of the capacity analysis, a hazardous waste treatment/recovery system was identified by each hazardous waste entry point into a unit process or sequence of unit processes. The system begins at the process unit where the hazardous waste stream(s) first enters and consists of all other treatment or recovery process units downstream from the point of entry.

The following examples demonstrate system identification. Figure 4.2.2 shows a simple hazardous wastewater treatment system. Hazardous waste can only enter the three unit processes for treatment at one point, the chemical precipitation process. Therefore, there is only one hazardous waste treatment system. The system consists of chemical precipitation, clarification/settling, and sludge dewatering (filter press) processes. Note that by this method, recycle streams and nonhazardous waste streams do not affect system identification.

Figure 4.2.3 depicts three hazardous waste treatment systems. Three hazardous waste entry points exist at three different units which perform three different processes. The chromium waste treatment system consists of chromium reduction, chemical precipitation of chromium, settling, and sludge dewatering processes. The cyanide waste treatment system consists of a cyanide oxidation process followed by chemical precipitation of

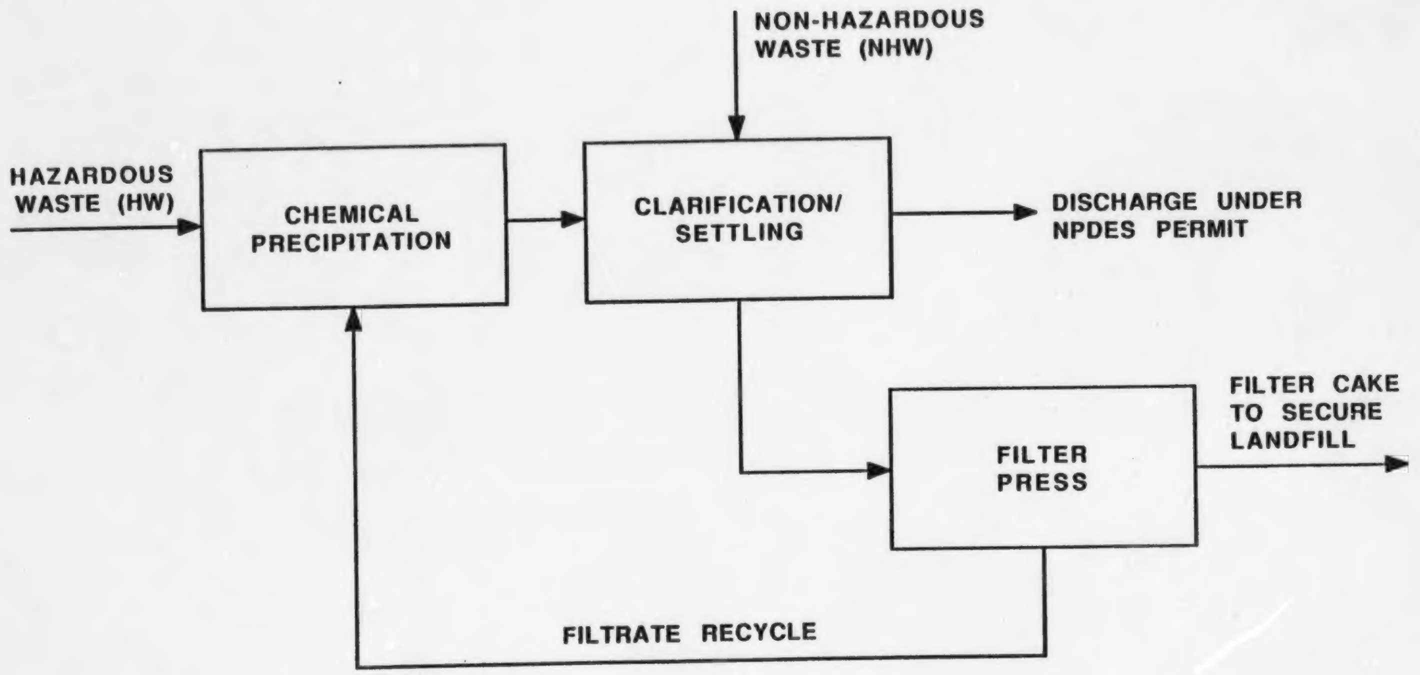
NON-HAZARDOUS WASTE (NHW)
HAZARDOUS WASTE (HW)
CHEMICAL PRECIPITATION
CLARIFICATION/ SETTLING
DISCHARGE UNDER NPDES PERMIT
FILTER CAKE TO SECURE LANDFILL
FILTER PRESS
FILTRATE RECYCLE

FIGURE 4.2.2 FLOW DIAGRAM OF A SIMPLE SYSTEM

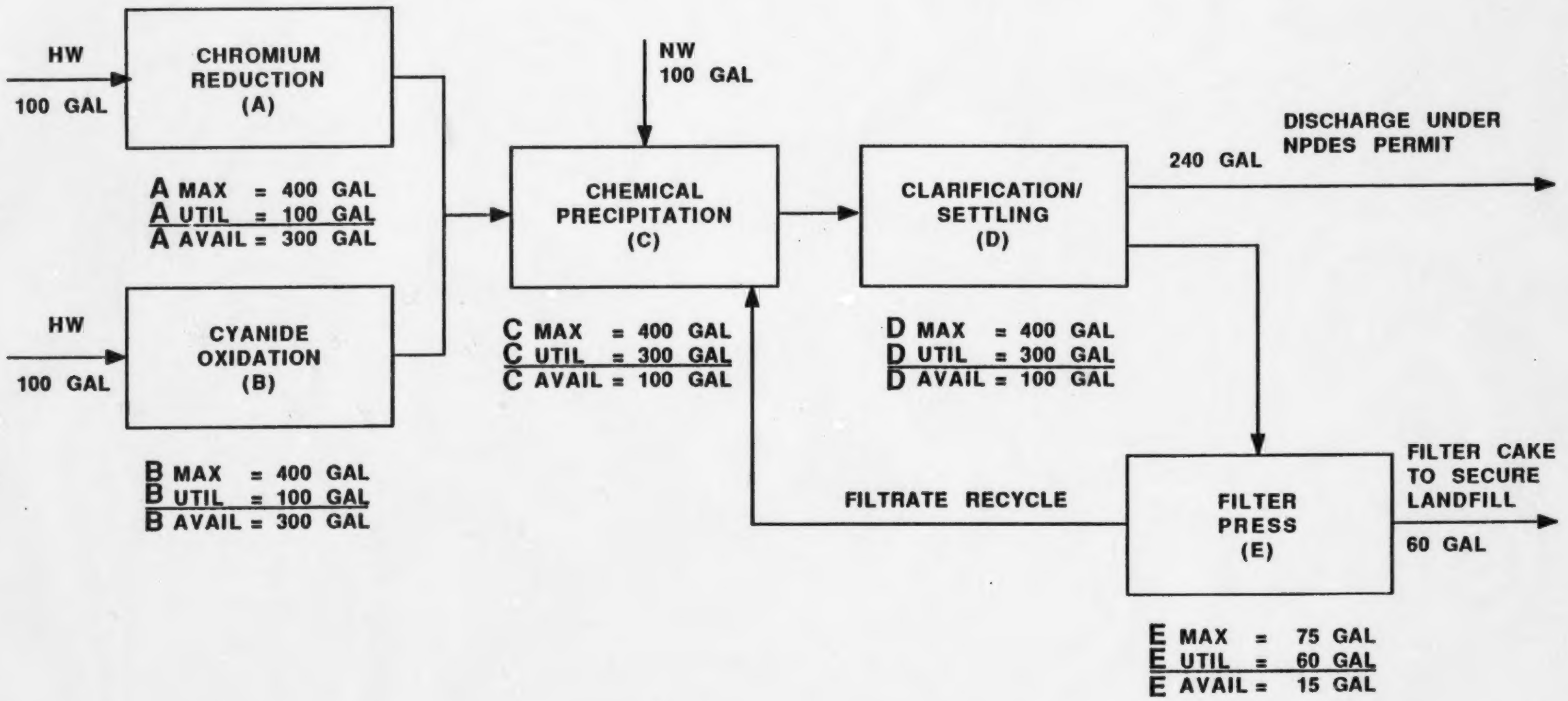
HW
100 GAL
CHROMIUM REDUCTION (A)
A MAX = 400 GAL
A UTIL = 100 GAL
A AVAIL = 300 GAL
HW
100 GAL
CYANIDE OXIDATION (B)
B MAX = 400 GAL
B UTIL = 100 GAL
B AVAIL = 300 GAL
NW
100 GAL
CHEMICAL PRECIPITATION (C)
C MAX = 400 GAL
C UTIL = 300 GAL
C AVAIL = 100 GAL
CLARIFICATION/ SETTLING (D)
D MAX = 400 GAL
D UTIL = 300 GAL
D AVAIL = 100 GAL
240 GAL
DISCHARGE UNDER NPDES PERMIT
FILTRATE RECYCLE
FILTER PRESS (E)
E MAX = 75 GAL
E UTIL = 60 GAL
E AVAIL = 15 GAL
FILTER CAKE TO SECURE LANDFILL
60 GAL

FIGURE 4.2.3 FLOW DIAGRAM OF THREE SYSTEMS WITH UNIT PROCESS CAPACITIES

metals, and settling and dewatering of the resultant treatment sludge. The third is a treatment system for a general metal containing waste consisting of chemical precipitation of metals, settling, and sludge dewatering. Note that the three systems share some of the same unit processes. These three systems may be linked together by competing for the capacity of the shared units. If system capacity determination reveals that at least one of the shared units limits the capacity of at least one of the treatment systems, then the three systems are considered as linked systems.

At first glance, Figure 4.2.4 appears to show two systems because there are two hazardous waste entry points. Upon close examination, one discovers that the two waste streams feed into two different tanks which conduct the same process in parallel. For purposes of capacity analysis, these two units are considered as one process with the utilized and maximum capacities of the "agglomerated unit" equal to the sum of the utilized and maximum capacities of each of the individual units. Therefore, Figure 4.2.4 depicts only one hazardous waste treatment system.

(3) Determination of System Capacity. To determine the capacity of a treatment system, the utilized and maximum capacity of each unit process must be examined. Where several systems share unit processes, such as in Figure 4.2.3, all the unit processes that make up each of the potentially linked systems must be considered together for this portion of the analysis.

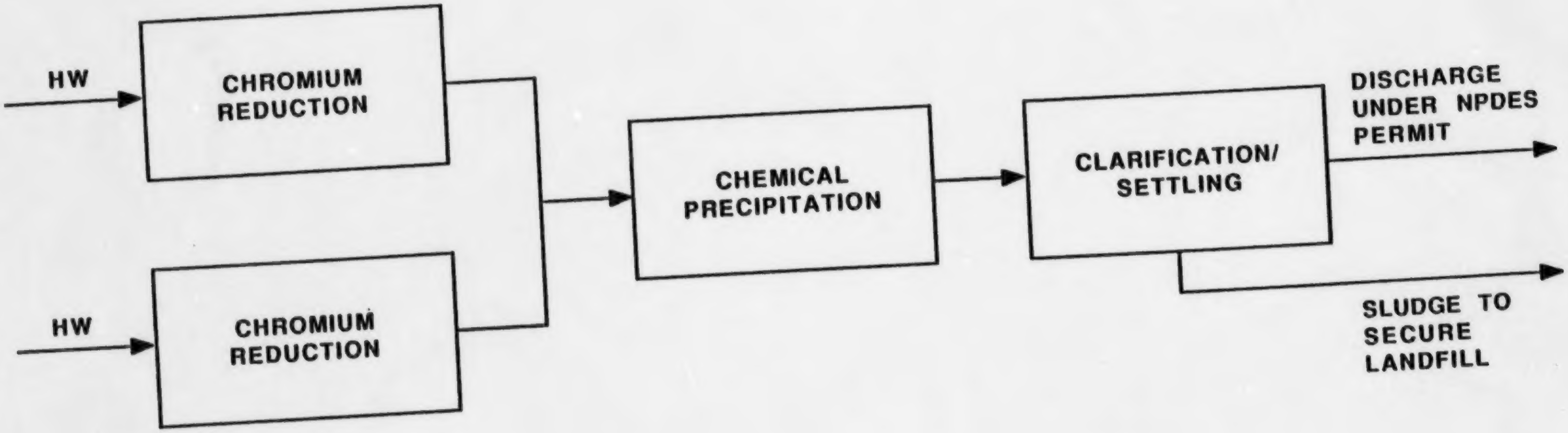
HW
CHROMIUM REDUCTION
HW
CHROMIUM REDUCTION
CHEMICAL PRECIPITATION
CLARIFICATION/ SETTLING
DISCHARGE UNDER NPDES PERMIT
SLUDGE TO SECURE LANDFILL

FIGURE 4.2.4 FLOW DIAGRAM OF ONE SYSTEM WITH TWO UNITS CONDUCTING THE SAME PROCESS

The capacity determination takes a "snapshot" approach, treating batch and continuous processes similarly by conducting a mass balance based on the amount of waste that was treated and could be treated during the entire year. Survey respondents reported unit capacities as the amount of hazardous waste entering the unit in 1986, the amount of nonhazardous waste entering the unit in 1986, the hazardous waste maximum capacity, and all waste maximum capacity. Volumes from internal recycle streams are considered in the volumes respondents report for utilized and maximum unit capacities, therefore, recycle streams are not considered separately when conducting systems analysis.

The available capacity for each unit was calculated by subtracting the utilized from the maximum capacity. The available capacities of upstream units were compared with each unit in the process string to locate the limiting unit(s) in the system(s). The system capacity is based on the affect of the limiting unit.

The above methodology assumes a 1986 base line for hazardous and nonhazardous wastes already being treated in the system and only uses that portion of the system's remaining capacity which the respondent claims may be used for hazardous waste treatment. It was assumed that when a survey respondent reported hazardous waste maximum capacity to be less than all waste maximum capacity the respondent considered how much nonhazardous waste he must treat using his system when reporting the hazardous waste maximum capacity for the unit.

The available capacity of a simple system is the available capacity of the limiting unit. In Figure 4.2.5, B is the limiting unit because it has the smallest available capacity. If one were to try to treat 50 gallons of additional hazardous waste using this system there would be a bottleneck at unit process B because it only has room for an additional 25 gallons of waste. Therefore, the system only has 25 gallons of available hazardous waste treatment capacity. The maximum hazardous waste treatment system capacity would be 75 gallons or 50 gallons of hazardous waste capacity already utilized plus the additional 25 gallons of available capacity based on limiting unit B.

When analyzing more complicated systems, care must be taken that the total available capacities which affect a downstream unit are considered. Referring to the unit capacities provided in Figure 4.2.3, if the amount of waste being treated in units A and B were increased by 300 gallons in each unit (i.e., run them at their maximum capacities), unit C would become a bottleneck because it only has 100 gallons of available capacity. In other words, when units directly upstream of the unit of concern are in parallel one must add the available capacities of the upstream units before comparing them with the available capacity of the unit of concern to determine if it limits the maximum capacity of the upstream units (Example: $A_{Avail} + B_{Avail} = 600$ gal and 600 gal $> C_{Avail}$).

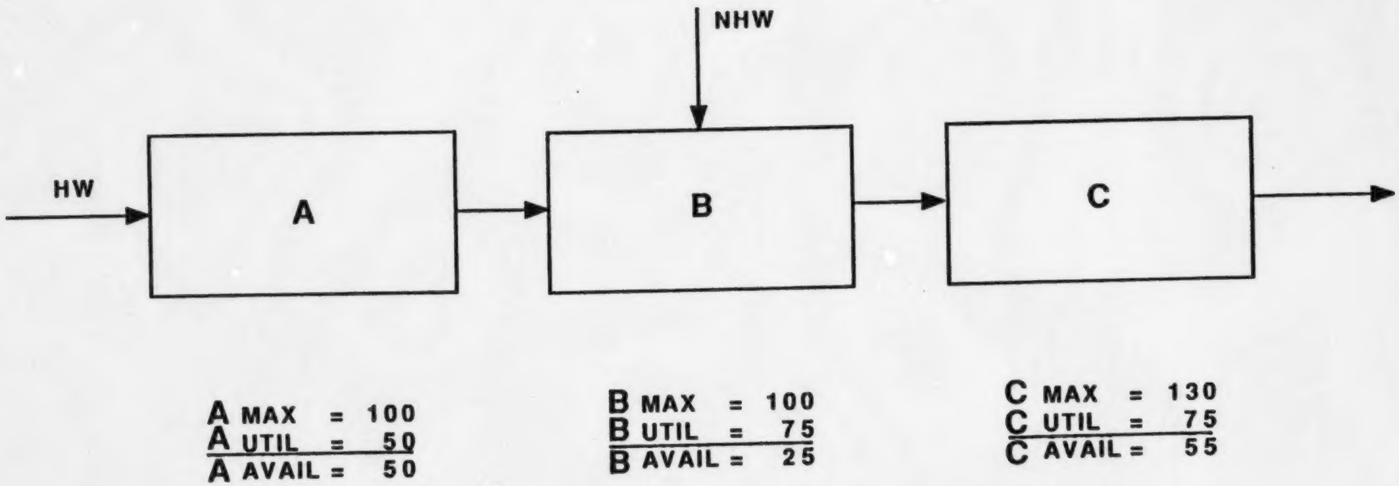
NHW
HW
A
B
C
A MAX = 100
A UTIL = 50
A AVAIL = 50
B MAX = 100
B UTIL = 75
B AVAIL = 25
C MAX = 130
C UTIL = 75
C AVAIL = 55

FIGURE 4.2.5 FLOW DIAGRAM WITH UNIT CAPACITIES

The effective available capacity of an upstream unit must be calculated for comparison with the downstream unit's available capacity when only a portion of the waste treated in the upstream unit is also treated in the downstream unit of concern. Referring to Figure 4.2.3, the effluent stream from the clarifier being discharged under NPDES permit must be considered when determining the effect of using the available capacity of the clarifier on the available capacity of the filter press. That fraction of waste being treated in the upstream unit which continues to the downstream unit is calculated. Under the assumption that as the utilized capacities of these units are increased the percentage of waste that is treated in both upstream and downstream units remain constant, the calculated percentage is applied to the reported available capacity of the upstream unit before comparing it with to the available capacity of the downstream unit.

In Figure 4.2.3, fraction of waste (D_p) going from the clarifier to the filter press (Unit E) is calculated by:

$$D_p = \frac{E_{util}}{D_{util}} = \frac{60}{300} = 0.2$$

Twenty percent of the waste treated by unit D gets treated by unit E. Now the available capacity of the clarifier affecting the filter press (D_{eal}) is calculated:

$$D_{eal} = (D_p)\ (D_{avail}) = (0.2)\ (100) = 20 \text{ gallons}$$

If the amount of waste being treated in the clarifier is increased to its maximum capacity then 20 more gallons of waste would flow to the filter press. Comparing the effective available capacities, however, indicates that the filter press limits the maximum capacity reported for the clarifier:

$$E_{avail} < D_{eal} \text{ or } 15 \text{ gallons} < 20 \text{ gallons}$$

Considering the fact that the filter press limits the maximum capacity of the clarifier, the "new" available capacity of the clarifier must be compared to the capacity of the upstream unit, the chemical precipitation unit. The limiting effect of the filter press on the available capacity of the clarifier (D_{nac}) is quantified as follows:

$$D_{nac} = \frac{E_{avail}}{D_p} = \frac{15}{0.2} = 75 \text{ gallons}$$

Based on the comparison of the "new" available capacity of the clarifier with the upstream chemical precipitation unit and the earlier comparison made between the chemical precipitation unit and the parallel upstream units, the filter press limits the capacities of all the other units in the process string.

At this point, the capacity analysis switches from a unit by unit analysis to a systems analysis. The affect of the limiting unit on the system's available and maximum capacity is determined. As previously discussed, Figure 4.2.3 shows three hazardous waste treatment systems. The utilized capacity of each of these systems is the amount of waste that enters each system for their respective treatments. The utilized capacity for the chromium waste treatment, cyanide waste treatment, and metals waste treatment is each 100 gallons. The available capacity of each system, as determined by the effect of the limiting unit, is 75 gallons. This quantity, which was derived above, reflects the effluent stream that exits the systems upstream from the limiting filter press. The maximum capacity of each system equals the utilized capacity of the system plus the available capacity of the system. The maximum capacities of the chromium waste, cyanide waste, and metals waste treatment systems each equals 175 gallons.

When waste treatment systems share a limiting unit, as exemplified by the three systems shown in Figure 4.2.3, they compete for the available capacity of that limiting unit. Because of this competition for scarce capacity, these linked systems cannot all operate at their maximum capacities as calculated above. A linked system can only operate at its maximum capacity if all the other systems to which it is linked continue to operate at the utilized capacities reported for 1986. The maximum capacities of each of the linked systems serve as end points when trying to find sufficient capacity for waste volumes requiring treatment. Using the example shown in Figure 4.2.3 to illustrate, if additional chromium waste is sent to the chromium treatment system, then there is that much less additional capacity for cyanide waste and metals waste treatment. If the chromium waste treatment system operates at maximum capacity then no additional waste may be sent to the cyanide waste or metals waste treatment system. A methodology was developed so that capacity tradeoffs may be made between linked systems, using more available capacity for the crucial treatment system at the expense of the maximum capacities of the other less crucial linked systems. Tradeoffs would be determined by the demand, as quantified by the required capacity analysis, for the various types of treatment systems.

To avoid over estimating of available treatment capacity and to provide a starting point upon which available capacity tradeoffs between linked systems may be made, a proportioned system capacity is calculated for linked systems. The proportioned system capacity is based on how much of the limiting unit's capacity was devoted to each linked system during the TSDR survey base year of 1986. First, the fractional flow of hazardous waste contributed by each linked system to the limiting process is determined. Using the systems shown in Figure 4.2.3:

Fractional flow of chrome treatment system = CR_p
Fractional flow of cyanide treatment system = CN_p
Fractional flow of metals treatment system = M_p

$$CR_p = \frac{CR_{util}}{CR_{util} + CN_{util} + M_{util}} = \frac{100}{100 + 100 + 100} = \frac{100}{300} = 0.333$$

$$CN_p = 0.333;\ M_p = 0.333$$

Note that M_{util} is the utilized capacity of the metals treatment system, not the utilized capacity of the chemical precipitation unit. The utilized capacity of the chemical precipitation unit is the sum total of the utilized capacities of all three systems.

The effect of the limiting unit on each available system capacity is proportioned to each system based on the fractional flow determination. Continuing the calculation to determine the proportioned available capacity (CR_{pac}) using the above example:

$$CR_{pac} = (CR_p)\ (D_{nac}) = (.333)\ (75) = 25 \text{ gallons}$$

$$CN_{pac} = (CN_p)\ (D_{nac}) = 25 \text{ gallons}$$

$$M_{pac} = (M_p)\ (D_{nac}) = 25 \text{ gallons}$$

Note that D_{nac}, the previously calculated "new" available capacity of unit D, reflects the effect the limiting unit has on all three systems and accounts for the effluent stream that exits the system before reaching the limiting unit.

When a linked system has an unshared limiting unit upstream from the mutually shared limiting unit of the other linked system(s), the system's calculated proportioned available system capacity must be compared with the available capacity of its limiting unit. If the limiting unit's available capacity is less than the calculated proportioned available system capacity, the final proportioned available system capacity equals the available capacity of the unshared limiting unit. The remainder of the calculated proportioned available system capacity is redistributed to the remaining linked systems based on how much the mutually shared limiting unit is devoted to the remaining linked systems. In the example shown in Figure 4.2.3, the limiting unit for all three systems is the shared filter press; therefore, no comparisons are necessary.

The proportioned maximum system capacity equals the utilized system capacity plus the proportioned available system capacity. The proportioned maximum system capacity (PMC) for the systems displayed in Figure 4.2.3 are:

$$CR_{PMC} = CR_{util} + CR_{pac} = 100 + 25 = 125 \text{ gallons}$$

$$CN_{PMC} = 125 \text{ gallons}$$

$$M_{PMC} = 125 \text{ gallons}$$

(4) Projections of Available Capacity. The TSDR Survey obtained capacity data for the base line year 1986 and for changes or new operations planned through 1992. Only capacity data presented for the years 1986, 1987, and 1988 were used in the to support the First Third proposed rule. Projections of capacity beyond 1986 were obtained from the TSDR Survey by engineering analysis of information regarding new treatment/recovery systems being installed and equipment changes being made to the systems operating in 1986 that result in changes in system capacity.

For new systems, capacity analysis was conducted as described above and the results were input into the treatment system PC data base for the appropriate years. Reported equipment changes to treatment systems operating in 1986 were examined to determine their affect on the system capacity. If the change involved the system's limiting unit or influenced the effect of a limiting unit on the system, then capacity analysis was performed again, incorporating the capacity changes for that year.

4.2.3 Development of the Treatment Capacity Data Set and Results

The treatment/recovery capacity data set consists of a PC incineration/ reuse as fuel data set and a PC other treatment systems data set. System capacity data derived from data reported in the TSDR survey, as described above, were entered onto PC data sheets. The purpose of these forms was to standardize information required for assessing available treatment capacity that was to be obtained from the TSDR survey and entered into a PC data base. The PC data base is described in a report which may be found in the docket for this proposed rule (Ref. 14). A detailed discussion of the PC data entry sheets may also be found in the docket for this proposed rule (Ref. 13).

The following discussion presents the results of the incineration/ reuse as fuel data set.

(1) Incineration/reuse as fuel data set results. Table 4.2.1 summarizes the commercial capacity for hazardous waste incineration. This table presents the utilized, maximum, and available capacity for incineration of liquids, sludges, solids, and gases in 1986, and maximum and available capacity for 1987, 1988, 1989, and 1990. The analysis assumes that hazardous waste capacity not utilized in 1986, and all new hazardous waste capacity from 1987 and beyond, will be available for incineration of hazardous wastes.

Table 4.2.1 Commercial Hazardous Waste Incineration Capacity (Million Gallons/Year)

Physical form of waste	1986			1987		1988		1989-1990	
	Utilized capacity	Maximum capacity	Available capacity	Maximum capacity	Available capacity[a]	Maximum capacity	Available capacity[a]	Maximum capacity	Available capacity[a]
Liquids	63	79	16	118	55	149	86	188	125
Sludges	4	9	5	9	5	13	9	72	68
Solids	17	27	10	27	10	52	35	131	114
Gases	0	1	1	1	1	2	2	3	3
TOTAL	84	116	32	155	71	216	132	394	310

Source: TSDR Survey results as of April 11, 1988. Data from 30 facilities, including 24 operational units in 1986 and a total of 42 projected units (current and planned) in 1989 and 50 units in 1990.

[a] Projected based on maximum capacity for that year minus utilized capacity for 1986. This considers that capacity not utilized in 1986 and all new capacity (from 1987 and beyond) will be available for incineration of hazardous wastes being land disposed that may be affected by the land disposal restrictions.

Table 4.2.2 summarizes the commercial capacity of industrial kilns for reusing hazardous wastes as fuel. The table presents the utilized, maximum, and available capacity for combustion of liquids, sludges, and solids as fuel in 1986, and maximum and available capacity for 1987, 1988, and 1989-1990. Again, the analysis assumes that hazardous wastes capacity not utilized in 1986, and all new hazardous wastes capacity from 1987 and beyond, will be available for combustion of hazardous wastes.

(2) Development of the PC data base for other treatment systems. PC data forms were filled out for other treatment systems and the data were entered into a PC data base. The data base was prepared to assist in the capacity analysis using a software package called Jazz, manufactured by the Lotus Development Corporation. The data base contains data entry fields as well as calculated fields used to perform the capacity analysis. A more detailed explanation of the data fields contained in the data base may be found in a report in the docket for this proposed rule (Ref. 14).

There are four major treatment system categories in the data base. Each of the four major categories is divided into subcategories. A more detailed discussion of how and why the categories were developed is given below. The categories and subcategories, along with the codes used to represent them within the data base, are listed as follows:

I. Wastewater Treatment

Process	Code
- Cyanide Oxidation	WW, CO
- Chrome Reduction	WW, CR
- Organics/Metals Treatment	WW, OMT

Table 4.2.2 Commercial Capacity of Industrial Kilns for "Reuse Fuel" of Hazardous Waste (Million Gallons/Year)

Physical form of waste	1986			1987		1988		1989-1990	
	Utilized capacity	Maximum capacity	Available capacity	Maximum capacity	Available capacity[a]	Maximum capacity	Available capacity[a]	Maximum capacity	Available capacity[a]
Liquids	55	167	112	214	159	216	161	288	233
Sludges	<1	1	1	1	1	2	2	4	4
Solids	<1	1	1	1	1	1	1	2	2
TOTAL	55	169	114	216	161	219	164	294	239

Sources: (1) TSDR Survey results as of April 8, 1988. Data from 21 facilities, including 37 operational units in 1986 and 49 units projected (current and planned) for 1989 to 1990.

NOTE: For cases where capacity was added to existing units or by new units, all facilities indicated new capacity would be available 100 percent for hazardous waste.

[a] Projected based on maximum capacity for that year minus utilized capacity for 1986. This considers that capacity not utilized in 1986 and all new capacity (from 1987 and beyond) will be available for burning (reuse as fuel) of hazardous wastes being land disposed that may be affected by the land disposal restrictions.

I. Wastewater Treatment (continued)

Process	Code
- Organics/Metals Biological Treatment	WW, OMB
- Sulfide Precipitation	WW, SP
- General Chemical Precipitation	WW, GCP
- Steam Stripping	WW, SS
- Air Stripping	WW, AS
- Biological Treatment	WW, BT
- Carbon Adsorption	WW, CA
- General Oxidation	WW, GO
- Wet Air Oxidation	WW, WAO
- Neutralization	WW, N

II. Solvent Recovery

Process	Code
- Thin Film Evaporation	SR, TF
- Fractionation/Distillation	SR, FD
- Solvent Extraction	SR, SE
- Other Solvent Recovery	SR, O

III. Metals Recovery

Process	Code
- High Temperature Metals Recovery	MR, HT
- Retorting	MR, R
- Secondary Smelting	MR, SS
- Other Metals Recovery	MR, OMR

IV. Solidification

Process	Code
- Solidification	SL, S

The maximum, utilized, and available capacities were totaled for all systems in the data base that fell under each category. Each category is mutually exclusive so that the capacity of a treatment system would not get double counted. The treatment systems were categorized by using the computer to search each record for key unit types (process codes) that would identify the appropriate category under which the system should be placed. For example, records indicating systems with unit types identified by process codes 2WT, 3WT, 4WT, or 5WT, and 10WT through 15WT were categorized under cyanide oxidation. These categories are used because the BDAT program has identified them as treatment methods that may be effective in attaining the treatment standards established under the solvents and dioxins, California List, and First Third Proposed rulemakings.

(3) Treatment capacity data set results. Only a subset of the treatment systems that comprise the treatment capacity data set were required by solvents, California List HOCs, and First Third proposed wastes. These treatment categories have been identified under the BDAT program as being effective in attaining the applicable treatment standards. Under each category, only commercial treatment systems were aggregated to establish a National supply of available treatment capacity that may be used to meet the demand created by the Land Disposal Restrictions Rule.

Table 4.2.3 presents the maximum, utilized and available capacities of commercial treatment systems (other than combustion) of concern for reporting baseline year 1986 and capacity projections through 1990. The 1986 utilized capacities of these treatment systems was assumed to remain constant for the subsequent years in making these projections. Where a

Table 4.2.3 Commercial Treatment System Capacities (Million Gallons/Year)[a]

Technology description	Utilized	1986		1987		1988		1989-1990	
		Maximum capacity	Available capacity	Maximum capacity	Available capacity	Maximum capacity	Available capacity	Maximum capacity	Available capacity
Stabilization	>67	>787	>720	>330	>263	>496	>429	>979	>912
High temperature metals recovery	34	67	34	67	34	67	34	67	34
Cyanide oxidation and chemical precipitation	29	107	78	107	78	193	164	217	188
Chromium reduction and chemical precipitation	130	323	193	323	193	324	195	324	195
Carbon adsorption and chromium reduction/chemical precipitation	4	16	12	16	12	16	12	16	12
Carbon adsorption and chemical precipitation	6	33	28	33	28	33	28	33	28
Chemical precipitation	84	218	134	218	134	220	136	233	149
Sulfide precipitation	54	298	244	298	244	301	247	302	248
Neutralization	18	58	40	58	40	58	40	58	40
Steam stripping	1	12	11	12	11	12	11	12	11
Carbon adsorption	5	7	2	7	2	17	11	28	23
Biological treatment	106	140	35	140	35	157	51	173	67
Wet air oxidation	3	3	<1	<1	<1	5	2	5	2

[a] Numbers may not add because of rounding.

linked system exists, the proportioned system capacity for the linked system is used to avoid overestimating available capacity. For commercial treatment systems that closed between 1986 and 1988 or will close in 1989 or 1990, the utilized capacity of that system remained in the analysis under the assumption that the waste volumes the system was treating will require commercial capacity elsewhere. Keeping the utilized capacity of the closed system in the analysis results in reducing the available commercial capacity for that category. Available capacity values presented in parentheses on Table 4.2.3 represent the utilized capacities of systems which close or the amount of waste treated in 1986 that can no longer be treated by a system because of a reduction in its maximum capacity. When summing the available capacity columns, the numbers in parentheses are treated as negative values. The data in this table was summarized from a report on commercial treatment capacity (Ref. 14).

Table 4.2.4 is a summary of the 1988 capacity data for all commercial treatment systems of concern for this proposed rule. The combustion data includes incineration and reuse as fuel in industrial kilns. These data represent the supply (available capacity) for the demand (required capacity) presented earlier.

4.3 Capacity Analysis (Comparison of Required and Available Treatment Capacity)

As previously described, the Agency is responsible for determining whether sufficient capacity exists to meet the requirements of the land disposal restrictions. This involves the comparison of required and

Table 4.2.4 Overview: 1988 Capacity for Alternative Treatment/Recovery Technologies[a]

Technology description	Maximum capacity (million gallons/year)	Utilized capacity (million gallons/year)	Available capacity (million gallons/year)
Combustion			
- Liquids	365	118	247
- Sludges	15	4	11
- Solids	53	17	36
Stabilization	>496	>67	>429
Metals recovery			
- Mercury retorting	0	0	0
- High temperature metals recovery (not secondary smelting as identified in the TSDR survey)	67	34	34
Wastewater treatment			
- Cyanide oxidation, chemical precipitation, and settling/filtration	193	29	164
- Chromium reduction, chemical precipitation, and settling/filtration	324	130	195
- Carbon adsorption and chromium reduction, chemical precipitation, and settling/filtration	16	4	12
- Neutralization	58	18	40
- Steam stripping	12	1	11
- Carbon adsorption	17	5	11
- Biological treatment	157	106	51
- Wet air oxidation	5	3	2
Sludge treatment			
- Acid leaching, chemical oxidation, and dewatering of sludge and sulfide precipitation of effluent	0	0	0

[a] Numbers may not add because of rounding.

available capacity. Available treatment capacity can be obtained from the following sources:

- Onsite (private capacity) - facilities that only manage waste generated onsite.
- Captive capacity - facilities that only manage waste from other facilities under the same ownership.
- Limited commercial capacity - facilities that manage waste from a limited number of facilities not under the same ownership.
- Commercial capacity - facilities that manage waste from any facility.

Available capacity from these sources is contained in the TSDR Survey data base. The data base contains information from base line year 1986 and information on planned changes to 1986 management methods and new processes to be installed from 1987 through 1992. The methodology for determining the amount of available treatment capacity was described in Section 4.2.

Required capacity consists of wastes previously land disposed that will require treatment to meet a treatment standard prior to being land disposed. These volumes of waste were identified and underwent treatability analysis as was described in Section 4.1. The result of treatability analysis was the assignment of waste volumes into treatability subgroups.

The comparison of required and available capacity was performed on a facility by facility basis. This was done in order to match treatability subgroups with available capacity of applicable treatment/recovery systems. Available onsite treatment capacity was only matched to volumes that were previously land disposed onsite and were determined to require alternate treatment. If the appropriate treatment/recovery technology was not available onsite, or if adequate available capacity was not present to manage the waste, then the remaining volume of waste requiring alternate treatment was aggregated into a national demand for commercial capacity. The final aggregate of national demand was then compared with the final estimates of national commercial capacity in order to match treatability subgroups with appropriate treatment technologies. This methodology was used by the Agency to make final determinations concerning variances.

5.0 BIBLIOGRAPHY

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APPENDIX A

Capacity Analysis for Solvent Wastes

APPENDIX A

The tables in this appendix present the results of the analysis of required capacity for each alternative technology on a waste-code-by-waste-code basis. The tables show the amount of required treatment capacity in 1988 for each solvent waste code. The tables also total the amount of required capacity for each technology.

The original TSDR survey data were sorted by waste code and type of alternative treatment required to generate these tables. The tables were then combined and summarized to create the technology-specific capacity analysis table for solvent wastes contained in Section 3 of this document.

APPENDIX A

SOLVENTS

Technology: Combustion of liquids

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
F001	132,661
F002	380,688
F003	233,943
F004	19,765
F005	379,646
	1,146,703

5035s/2

APPENDIX A (continued)

SOLVENTS

Technology: Combustion of sludges/solids

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
F001	5,409,525
F002	11,255,064
F003	7,663,005
F004	3,537,657
F005	10,564,020
	38,429,271

APPENDIX A (continued)

SOLVENTS

Technology: Solidification/stabilization

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
F001	9,268
F002	9,423
F003	763,564
F004	523,295
F005	248,211
	1,553,761

APPENDIX A (continued)

SOLVENTS

Technology: Wastewater treatment - cyanide oxidation

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
F002	42,214
F003	42,214
F005	42,214
	126,642

APPENDIX A (continued)

SOLVENTS

Technology: Wastewater treatment - steam stripping, carbon adsorption, biological treatment, wet air oxidation

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
F001	193,760
F002	280,736
F003	196,371
F005	207,526
	878,393

APPENDIX B

Capacity Analysis for California List Halogenated Organic Compound Wastes

Appendix B

The tables in this appendix present the results of the analysis of required capacity for each alternative technology on a waste-code-by-waste-code basis. The tables show the amount of required treatment capacity for each of the HOC waste codes. The tables also total the amount of required capacity for each technology.

The original TSDR survey data were sorted by waste code and type of alternative treatment required to generate these tables. The tables were then combined and summarized to create the technology-specific capacity analysis tables for HOC wastes contained in Section 3 of this document.

APPENDIX B

Capacity Analysis by Technology per Waste Group/Code

Halogenated Organic Compounds (HOC) - First Third (Proposed)

Technology: Combustion of sludges/solids

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
K001	2,176,398
K019	72,000
K020	26,400
K016	513,120
K030	10,560
U077	3,840
	2,802,318

APPENDIX B (continued)

Capacity Analysis by Technology per Waste Group/Code

Halogenated Organic Compounds (HOC) - First Third (Not Proposed)

Technology: Combustion of liquids

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
U036	960
U226	5,520
U228	3,600
	10,080

APPENDIX B (continued)

Capacity Analysis by Technology per Waste Group/Code

Halogenated Organic Compounds (HOC) - First Third (Not Proposed)

Technology: Combustion of sludges/solids

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
F008	14,160
K085	99,600
P004	420
P037	420
P123	1,680
U036	4,500
U037	4,240
U044	4,760
U061	4,080
U129	900
U158	250,080
U209	4,800
U210	5,200
U211	1,640
U226	9,440
U228	4,720
U239	1,680
	412,320

APPENDIX B (continued)

Capacity Analysis by Technology per Waste Group/Code

Halogenated Organic Compounds (HOC) - First Third (Not Proposed)

Technology: Wastewater treatment

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
U210	1,700
	1,700

APPENDIX B (continued)

Capacity Analysis by Technology per Waste Group/Code

Halogenated Organic Compounds (HOC) - Not First Third

Technology: Combustion of liquids

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
U030	240
U073	240
U156	1,440
	1,920

APPENDIX B (continued)

Capacity Analysis by Technology per Waste Group/Code

Halogenated Organic Compounds (HOC) - Not First Third

Technology: Wastewater treatment

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
D014	1,920,000
K105	4,560
	1,924,560

5035s/12

APPENDIX B (continued)

Capacity Analysis by Technology per Waste Group/Code

Halogenated Organic Compounds (HOC) - Not First Third

Technology: Combustion of solids

	Required capacity 1988
Waste code	Without underground injection wastes (gallons/year)
D001	32,200
D012	451,200
D013	437,520
D014	120
D015	720
D016	199,920
P024	3,600
P028	720
U070	320
U071	320
U072	218,480
U076	8,880
U080	960
U240	26,934
U142	240
	1,382,134

APPENDIX C

Capacity Analysis for Contaminated Soil Wastes

Appendix C

The tables in this appendix present the results of the analysis of required capacity for each alternative technology for contaminated soils. The tables show the amount of required capacity for each technology.

The original TSDR survey data were sorted by waste description code (i.e., those described as soils) and by type of alternative treatment required to generate these tables. The tables were then combined and summarized to create the technology-specific capacity analysis tables for contaminated soils contained in Section 3 of this document.

APPENDIX C

Technology: Combustion of soils

	Required Capacity 1988
Solvents	25,131,748
First Third Proposed	
F006	15,360
K001	1,680,240
K019	4,080
K020	4,080
K022	610,320
K048	176,281
K049	7,307,130
K050	12,872
K051	876,333
K052	17,490
K104	84,960
K106	9,600
HOCs (First Third not proposed and not First Third)	3,931,347
Total	39,861,841

5035s/14

APPENDIX C (continued)

Technology: Solidification/stabilization of soils

	Required Capacity 1988
Solvents	27,632
First Third Proposed	
F006	5,599,973
K048	35,255
K049	1,469,426
K050	2,574
K051	175,219
K062	218,880
HOCs (First Third not proposed and not First Third)	0
Total	7,528,959

APPENDIX D

Treatability Groups

Waste Groups

TRD Group	Waste Code/A-B Codes
1	K022:A06,A09; K035:A06,A09; K036:A06,A09; K037:A06,A09; K045:A06,A07,A09; K047:A06,A09; K101:A06,A07,A09; K102:A06,A07,A09; K106:A09, F020:A06,A09; F021:A06,A09; F022:A06,A09; F023:A06,A09; F026:A06,A09; F027:A06,A09; F028:A09; F001:A09; F002:A09; F003:A09; F004:A09; F005:A09; F024:A06,A09; K001:A09; K009:A06,A09; K010:A06,A09; K015:A06,A09; K016:A06,A09; K017:A06,A09; K018:A06,A09; K019:A06,A09; K020:A06,A09; K021:A09; K028:A09; K029:A06,A09; K030:A06,A09; K032:A06,A09; K033:A06,A09; K034:A06,A09; K041:A06,A09; K042:A06,A09; K043:A06,A09; K073:A06,A09; K085:A06,A09; K095:A06,A09; K096:A06,A09; K097:A06,A09; K098:A06,A09; K099:A06,A09; K105:A06,A09; K116:A06,A09; F007:A09; F008:A09; F009:A09; F011:A09; K005,A09; K007:A09; K011:A06,A09; K013:A06,A09; K014:A06,A09; K060:A06,A09; K023:A06,A09; K024:A06,A09; K048:A09; K049:A09; K050:A09; K051:A09; K052:A09; K103:A09; K104:A09; D012:B36; D013:B36; D014:B36; D015:B36; D016:B36; D017:B36; U072:AEB; U036:A06; U066:A06; U080:A06; U226:A06; (D015,P123:B36); (F002,F005:B36); (F001,F003,F005:B36); (P044,P050,P071,P089:B36); (U220,U159:B36); (U226,U080,P054,F002:B36); (U240,P094:B36); U051:A06; U073;A06; U122:A06; (D016,D017:B36); (F003,F005:B36); (F003,F005,U019,U154:B36); U051:A06; U122:A06(S); U188:A06(S); U223:A06(S); U226:A06(S); U228:A06(S); (D001,F002:B36); (D001,F001,F002,F003,B005:B36); (D001,F002:B36); (D001,F002,F003,F005:B36); (D001,F002,F005:B36); (F001,F002,F003:B36); (F001,F002,F003,F004,F005:B36); (F002,F003:B36); (F002,F003,F005:B36); (F002,F005:B36); (F002,U019,U037,U070,U071,U072:B36); U009:A06; (F001,F002,F003,F005:B36); (K011,K013:B36); P063:A06; U108:A06(S); (F002:A06(S)); K001:A06(S); U036:A06; (F001,F002,F003,F004,F005:A09); U223:A06(S); U037:A06(S); U061:A06(S); U077:A06(S); K001:A06; K035:A06; P020:A06; P050:A06; P071:A06; U188:A06; (P020,P050,P071,P120,P037:B36); (D001,D002,U019,U211,U188:B36); (U051,K001:B36); (D001,D002,U037,U077,U067:B36); (D001,D002,F002,U226:B41); (U105,U106:B36); (U002,U154,U159,U161,U239:B36); (U147,U182,U219:B85); (U188,U122:AEI); P037:A08; P081:A09; U208:A06; P063:A06; F001:A06; F002:A06; F003:A06; F004:A06; F005:A06; U031:A06; U072:A06; U154:A06; P094:A06; U080:A06; U069:A06; U188:A06; U210:A06; P089:A06(S); (F001,F002,F003,F005:B43); (F002,F003,F005,U019:B36); (F002,F003,U012,P030,P004,P064:B42); (F002:B82; F003:B42; F005:B42); (F024,K019,K020,U077:B36); (K022,U188,U055:B36); (P123,U061:B36); (U022:B45; U080,U226:B36); (K104:A06); (U031,U220,U239:B36); (U003:A06); (U188,U052:B52); (U051,U165:B36)(U081,U188:B36)(U083,U140,U226:B36); U221:A06; U239:A06; U248:A06

Waste Groups (Continued)

TRD Group	Waste Code/A-B Codes
2	D012:B80,B81,B86,B89; D013:B80,B81,B86,B89; D014:B80,B81,B86,B89; D015:B80,B81,B86,B89; D016:B80,B81,B86,B89; D017:B80,B81,B86,B89; K034:A07; K043,K118:A07; U067:A06; U240,K061:A08; (P063:BID,BXA,U009:BID,BXA,K011:BID,K013:BID); (F001,F002,F004,F005:B89); U122:A07(S); (U019,U165,U220:B90); (U051,U052:B90); U072:A08(S); (U122,U159,U188,U220:B90); (U220,U226:B90); D001,D002,D003:B64; U188,U223,U051:A08; U221:A07(S); (F003,F005,P063:B11(S)); U069:A08; U080:A08; U158:A13; U188:A08,A09,A13; U210:A08; U228:A13; U188,U223,U051:A08; D012:B80; D016:B80; (P071,P123,U239:B81); U061:A08; (F002,F002:B84; F003,F004,F005:B90); (F002:B89,F004:B90); (K022,K083,U012,U055,U188:B45); U210:A08; U211:A08; U220:A08; (D001,F003,F004:B89) (D001,D002:B82) (D001,D002,D003:B82) (D002,F003,F005:B89) (D001,D014:B80) (D001,F003:B89) (D001,U122:B89) (D002,P089:B90) (D001,F003,F005:B89) (D002,F001,F005:B89); (U240,U192:B81) (F003,F004,F005:B89) (F004,D001:B89) (D001,F002,F003,F005:B89) (K001,U051:B89) (D001,D014,U240,U093:B80) (K022,K083:B90) (U012,U221:B90) (D014,U036,U093,P020:B80) (U070,U071,U072:B89) (U159,U220:B90) (D001,F001,F002,F003,F004:B89) (U180,U170,U226:B90) (U211,U044,U080:B89) (U213,U159:B90) (U220,U209:B89) (U239,U220:B90); (F001,F002,F003,F005:B89) (F001,F002,F003,F004,F005:B89) (F001,F002,F003,F005,D001:B89) (F002,F005,U165,U239,U107:B90) (F024,U077,K019,K020:B89) (K022,K083,U012,U055,U188:B90) (U036,U129,U247,P004,P037:B89) (U044,U080,U208,U211,U226:B89) (U070,U071,U072,U211:B89) (U037,U080,U210,U220,U228:B89) (K022,K085,U012,U055,U188:B90)
3	K009,K017,K029,K042,K095,K096,K116:A07; K014:A05,A07; D001:B69; D002:B59; D012,D013,D014,D015,D016,D017:B64; (D001:B62, D002:B05); (F001,F002,F003,F004,F005:B66); U007:A08; U080:A08; (U188:A08(L)); (U209:A08(L)); (U210:A08(L)); U220:A08(L); U044:RECODE; U074:A13; U012:A08(L); U044:A08(L); U122:A08; U151:A08; U154:A08; U159:A08; U227:A08; (F001,F002,F003,F004:A08); U180:A08; U169:A11; U030:A11; U073:A08; U122:A11; U156:A11
4	F001,F002,F003,F004,F005:A04; (F001,F002,F003:B71)
5	K047:A05,A07; (P071,P059,P050:B14); D003:B64; (D001,D002:B64); (D001,D002:B04); U122:A05

Waste Groups (Continued)

TRD Group	Waste Code/A-B Codes
6	D004:B66,B68,B73,B74,B77; D005:B66,B68,B73,B74,B77; D006:B66,B68,B73,B74,B77; D007:B66,B68,B73,B74,B77; D008:B66,B68,B73,B74,B77; D009:B66,B68,B73,B74,B77; D010:B66,B68,B73,B74,B77; D011:B66,B68,B73,B74,B77; (D007,P008:B74); (D004,D006,D007,D008:B30); D007:B30; (K027,D007,D008:B75); F019:A04; (D007,D008:B74); (F001,F002,F003,F005,D007:B40); (F003,F005,F006,K048:B40; K049:B); (K086:A04)
7	K010:A07; U154:A08
8	K106:A07; (K106,D009:B51)
9	F001:A01,A02; F002:A01,A02; F004:A01,A02; F005:A01,A02; U070:A08(L); (D001,U054,F001,F003,F005:B58); (U210,F001:B59); (F002,F003,F005:B61); (F002,U226:B59); (D001,D002:B61); (D001,F002,F003,F005:B61); (F003,F005:B61); (D001,F003,F008:B61)
10	F007:A05,A07; F009:A05,A07; F011:A05,A07; F008,F010:A05; D003:B07,B14,B16; D004,D005,D006,D008,D009,D010,D011:B07; (F006:B04,F007:B07,F008:F09); (F007:B07,F008:B09); P063:A08; (D002,F009:B07); (D002,D003,D008,D009:B09); (F002,F003,F005,D007,D008:B38)
11	F008:A07,A08; D003:B24; D004:B24,B25; D005:B24,B25; D006:B24,B25; D008:B24,B25; D009:B24,B25; D010:B24,B25; D011:B24,B25; F008,F009:B24; D007,F006:B24; (F006,F008:B31); (F006:B47; F007:B51) (F006,F008:B47); (F008,F009:B42)
12	D004:B14; D005:B03,B06,B10,B14,B16; D006:B03,B06,B10,B14,B16; D008:B03,B05,B06,B10,B13,B14,B15,B16; D009:B03,B06,B10,B14,B16,B17; D010:B02,B03,B06,B10,B13,B14,B16; D011:B03,B06,B10,B14,B16; K046:A05; (D002,D008,D009:B03); P122:A05; (D009:B05); D008:RECODE; (D002,D008:B14); (D006,D008:B14); (D002,D005,D006,D008:B03); (D002,D004:B03); (D006,D008:B03); (D002,D004,D006:B03); (D006,D008,D010:B14)
13	D005:B23,B31,B32; D006:B23,B31,B32; D010:B23,B31,B32; D011:B23,B31,B3[illegible]; D009:B23,B31,B32,B34; (D005,D006,D008:B31); D002,D004:B23; P010,P011,P012:A05,A08

Waste Groups (Continued)

TRD Group	Waste Code/A-B Codes
14	D007:B03,B06,B10,B13,B14,B16; (D002,D007:B03); D002:B03,B10; D007:BAC; (D006,D007,F007,F009:B05); (D002,D007,D008,D009:B03); (K048:B01,K049:B02); (D002,D007,D009:B05); (D002,D007:B05); (D002:B05, D007:B13, F019:B03, F001:B01); (D007:B13, F019:B03); (D002:B05, D007:B06); (D005,D007,D008,D011:B02); (D002,D007,D008:B06); (D002,D006,D007,D008,F007,F009:B05); F006:A06; (P011,U032:B14); (D002,D005,D006,D007,D008:B13); (D002,D006,D007,D008:B03); (D002,D003,D007:B09); (D002,D003,D006,D008:B03); (D002,D004,D006,D007,D009:B14); (D002,D007,D010:B14); (D002:B05, D007:B06); K051:A05
15	D007:B23,B31,B32,B35; K062:AEA; (D004,D005,D006,D007,D008,D009,D010,D011:B23); (K069:A06); (K062:A06); (D004,D006,D007,D008,D010:B20)
16	D003:B08; P030:A05; (D002,D003:B09)
17	D003:B75; P030:A06,A07,A08
18	D004:B20,B22; D005:B20,B22; D006:B20,B22; D007:B20,B22,B30; D008:BEA; D009:B20,B22; D010:B20,B22; D011:B20,B22; F006:A06,A07,A10,A11,A05S,AAB; F019:A06,A07,A10; K002:A06,A07,A10,B20; K003:A06,A07,A10,B20; K004:A06,A07,A10; K005:A06,A07,A10,B20; K006:A06,A07,A10,B20; K007:A06,A07,A10,B20; K008:A06,A07,A10; K044:A07,A10; K046:A06,A07,A10; K048:A10; K049:A10; K050:A10; K051:A10; K052:A10; K062:A06,A10,AAB; (F019,D007:B22); U032:A06; (K061,K062:BID);(D007,D008,K061,F006:BID); D002,D008:B19; (D002,D008:B20); F006:BAB; XASH:B39; K061:A10; (K061,D008:B37); (D008:B36); (K044:A07); (D002,D004,D010:B20); (F006,D007,D008:B37); P012,P110:A06; P015:AAF; P120:A06; (D005,D006,D007,F006:B41); (F006,F019:B41); (D008,F006:B51); (K044,K046:B41); (F005,D008:B38); (F006,D005,D006,D007:B51); (K031,D006:B37); (P015:A08); (U144:A08)
19	K097:A05,A07; K098:A05,A07; K099:A05,A07; K073:A05,A07(L); K033:A05,A07; D012:B02,B16; D013:B02,B16; D014:B01,B02,B16; D015:B02,B16; D016:B02,B16; D017:B02,B16

Waste Groups (Continued)

TRD Group	Waste Code/A-B Codes
20	K028:A06,A07; K044,K049,K050,K051,K052:A06; (D007,D008,F002,F003,F005:B82); (D008,F003,F005:B36); (D008,F003:B36); (D001,D002,D003,D004,D005,D006,D007,D008,D009,D010,F003,F004,F006,F019:B56); (D001,D002,D003,D004,D005,D006,D007,D008,D009,F001,F002,F003,F004,F005,F006,K061,K062:BIK); (D001,D002,D003,D004,D005,D006,D007,D008,D009,F001,F002,F006:B36); (D001,D002,D003,D004,D005,D006,D007,D008,D010,D011,F001,F002,F006:B36); (D001,D006,F002,F003,F005:B36); (D001,D006,D007,D008,F001,F002,F003,F004,F006:BIK); (D001,D007,D008,F002:B36); (D001,D008,F002,F003:B36); (D001,D008,F002,F005:B36); (D001,F006:B36); D002,F006,F007,F009,K062:BIK); (D002,D003,D004,D005,D006,D007,D008,D010,D011,F001,F003,F006,F007,F008,F009:BIK); K048:A06(S); P120:A13(S); (D004,D008,D009,U061:B36); K051:A11(S); (D007,F002:B82); (D007,F005:B82); (F001,F002,F003,F004,F005:B89; D004,D005,D006,D007,D008,D009,D010,D011,D012,D013,D014,D015,D016,D017:B40; K086:B90; F006,F007,F008,F009,F010,F011,F012:B40); (F005,F006,D007:B36); (U188,U158:B42; D006,D007,D008:B43); (D008,U221:B90) (D001,F003,F008:B89) (D002,F008:B89) (F003,D008:B89) (F003,D009:B89); (D005,D006,D008,U028,U190:B90) (F003,F004,D008:B89) (K016,K031,F006,U101,U188:B90) (F006,K016,K031:B47) (F003,F019:B51) (K011,K013,F008:B90) (K027,D007:B90) (D004,K016,K031,U188:B52)
21	K105:A05,A07; U185:A05;
22	F010:A07
23	K111:A05,A07
24	(K016,K037:A07); (U061,U142:A08)
25	K018:A07; P039:A08
26	K019:A07; K020:A07; K030:A07

Waste Groups (Continued)

TRD Group	Waste Code/A-B Codes
27	K048:A07,A11; K049:A07; K050:A07; K051:A07; K052:A07; K086:A07(M); (K048,K049,K051:B73); (K050,K051:B73); (K048,K049,K050,K051:B73); P120:A08; (K048,K049,K050,K051,K052:B90); (K048,K049,K051:B90); K049:A11; K050:A11; K051:A11; (K048,K049,K050,K051:B73); K049:AAC; K049:AAD; (K048,K051:B73); (K048,K049,K051:BQB); (D003,K051:B26); (D002,K049:B73); (K048,K049,K050,K051,K052:B73); (K049,K051:B62(S)); (K049,K051:B22); (K048,K049:B73); (K049,K051:B90); (K048,K051:B90); (K048,K051:B73)
28	K071:A05,A07; (K071,K106:B52); (K071,K106,D002,D009:B51)
29	K103:A05,A07; K104:A05,A07; (K083,U012:B02)
30	K061:A07,AEA; U151:A08; D008:B20,B22
31	K062:A05,A07; (K062,D002:B03)
32	K015:A07
33	F003:A01,A02
34	K031:A06,A07
35	D002:B04,B05,B14,B35; (K062:B04, D002:B05); D002:BMB,B52; (K062:B04,D002:B05); F006:B04; U134:A05; D009:B30; F005:B20(M)
36	K011:A07; K013:A07; (K011,K013,P063,U009:B64); P069:A08; U009:A08; D008:B69; (D002,D003,U012,U037,U015:B64); (U012,U070:B64)
37	F020:A07(M); F021:A07; F022:A07; F023:A07; F026:A07; F027:A07; K073:A07; K060:A07 (sludges)
38	F020:A05,A07(L); F021:A05,A07; F022:A05,A07; F023:A05,A07; F026:A05,A07; F027:A05,A07; K060:A05 (liquids)

Waste Groups (Continued)

TRD Group	Waste Code/A-B Codes
39	K001,K022,K035,K036,F024,K032,K041,K083,K085,K087:A07; D012:B22,B30,B71,B79; D013:B22,B30,B71,B79; D014:B22,B30,B71,B79; D015:B22,B30,B71,B79; D016:B22,B30,B71,B79; D017:B22,B30,B71,B79; F001:A03; F002:A03; F003:A03,B74; F004:A03,B74; F005:A03,B74; P024,P089,P094,P123:A08; (F003,F005:B77); (K027,D002:B75); (F001:B61, F002:B71, F003:B72, F005:B63, XOIL:B63); K083:A07(M); (F001,F002:B71)
40	F001:A05,B01,B05; (U188,U031,U037:B01); F002:A05; F003:A05; F004:A05; F005:A05; P020:A05; U210:A05; U177:A05; U211:A05; U244:A05; (F003,F004,U008:B05); (U159,U041,U077,U083,U084:B01); (F001,U162:B05); (F001,F004,F005:B01); (F001,F002,F003,F004:B01); (F001,F003,F004,F005:B01); (U154,U239,F003,F005:B14); (K019,K030:B02); (U034,U044,U045,U220:B02); (D001,F002,F003,F005:B01); D001:B01
41	K073:A06
42	U031:A05; U154:B05; K016:AEE
43	P005:B06
44	D004:B66,B68,B63; D005:B66,B68,B63; D006:B66,B68,B63; D007:B66,B68,B62,B63; D008:B66,B68,B63; D009:B66,B68,B63; D010:B66,B68,B63; D011:B66,B68,B63; (D001:B62, K086:B66); K086:B66; (P005:B06, D001:B69); K086:A02; (D001,D002,D007:B63); (K048,K050:B62); (K048,K049:A05)
45	(K022,U188,U055,U002,D007:B02); (P056,D007:B14); (D001,D007,F002,F003,F005:B01)
46	(K022,U188,U055,U002:B02); U188:A05
47	U147:A05; U170:A05
48	(K062,D002,F003,F004,U008,U009:B05); (D006,D007,F001:B09)

Waste Groups (Continued)

TRD Group	Waste Code/A-B Codes
49	K011,K013:A05; U009:A05,B05; (K011,K013:A05); (K011,K013,K014:B02); (K011,K013,K014:B02,D002:B05); (K011,K013,U009,U154,U162,U192,U008,U007,P069,P063,F001:B05); (K011,K013,U009,U192,U008,U007,P069,P063:B05); (K022,K013,P003:B02, P063:B08); (U009:A06(L); (K011,K013,K014:B02, D002:B05); (D002:BAG)
50	K015:A05
51	D004:B06,B03,B10,B16,B18; (D002,D004:B10)
52	D004:B23,B31,B32
53	D004:B07
54	F010,F011:A07; F012,A05
55	K024:A07
56	K045,F001:A10; K062,P120:A11; (F003,F005:B38); (D006,D008,F001,F002,F003,F005,F006,K048,K049,K051:B40);
57	Lab packs
58	(K011,K013,K014:B30); K011:AED
59	(D008,F001:B51)
60	Soil/debris
61	K069:A07
62	F008:A04; (D004,D006,D008:B30); K084:A07(M)
63	None assigned
64	None assigned
65	(D007,D008,D001,K061,F006:BID); (D007,D008:B82); (D001,D005,D006,D007,D008,D010:B82); (D001,D006,D007:B82); (D008:B82); (D001,D007,K017:B82); (D001,D008:B82); (D001,D009:B32); K049,K050:A06(S); (K051,D008:B90); (D001,F001:B82); (F001,F005:B82)

Waste Groups (Continued)

TRD Group	Waste Code/A-B Codes
66	(F006,P029,P074,P121:B47); (F007,F008,F010,F011,F012:BID); F007,F008:A06; (F007,F009:B46); (F006,F012,K044,K046:B41); (F006,F012:B41(E)); (P029:A06) (P106:A06)
68	(K048:B01, K049:B02, K051:B21, XWWL:B62, XWWS:B82)
69	(D004,D008,D009:B26)
70	K049:A05
71	D008:B23,B29,B31,B32
72	None assigned
73	(K022,D001,D002,F001,F002,F003,F004,F005,P012,P018,P022,P056,P075,P098,P105,P106,P119,U001,U002,U004,U005,U006,U008,U012,U019,U031,U037,U044,U045,U052,U055,U056,U066,U069,U070,U071,U072,U077,U092,U101,U107,U112,U113,U115,U117,U118,U120,U122,U123,U133,U134,U140,U144,U151,U154,U159,U161,U165,U167,U188,U190,U196,U201,U209,U211,U219,U220,U226,U239:B01)
73A	(D003,D006,D007,D008,D010:B14)
74	(D007,D008,D009,K049:B73)
75	(D002,D005,D009,D011,D014:B05)
77	(D002,D007:B64); D007:B64
78	K031:A05; D008:B02; D005:B64
79	D007:B02
81	P105:A05
82	K086:A07(L),A05
83	(D001,D002,D003,D004,D005,D006,D007,D008,D009,D010,D011,D012,D013,D014,D015,D016:B70)
84	Mixed RCRA/radioactive wastes
85	K104:AAE

No longer generated: K004, K008, K021, K036, K060, K073, K100, K025

APPENDIX E

Alternative Treatment/Recovery Technology Groups

Alternative Treatment/Recovery Technologies (AT/RT) for Each Waste Group

TRD group	AT/RT codes
1	1
2	1,2
3	1b,2b
4	1a,2a,3,4
5	5,21,22
6	7a,41a
7	1b,2b,8
8	9,10
9	4,11,1b,2b
10	12,13,49
11	14,13,50
12	15
13	16,10
14	17
15	18
16	19
17	20
18	10
19	5,21,22,3,4
20	7
21	23,5,21,22,8
22	7,12,13,49
23	5,22,24,25
24	26,1a,2a
25	26,1b,2b
26	26,1a,2a,3,4
27	27,7a,41a
28	28
29	29
30	30,31
31	32,17
32	34,1b,2b
33	1b,2b,3,4,11
34	10,35
35	38
36	1b,2b,5,21,22
37	1a
38	1b
39	1a,2a
40	5,21,22,24,6
41	52
42	6,21,22
43	44

Alternative Treatment/Recovery Technologies (AT/RT) for Each Waste Group (continued)

TRD group	AT/RT codes
44	7b,41b
45	36,40
46	5,6,21,22
47	6
48	42,43
49	5,21,22,67
50	34,1b,2b
51	45
52	46
53	47,48
54	39
55	26,1,2
56	51
57	53
58	1a,2a,21,22
59	56,41
60	54
61	55
62	56a,41a
63	56b,41b
64	56c,41c
65	7,41
66	14,50
67	57
68	58
69	62
70	63,64
71	10,16,30,31
72	13
73	59,60
73A	65,66
74	59,60,61
75	48,59
77	7b,36,41b,43
78	13,68
79	36,42,43
81	21,22,70
82	69
83	7a
84	70
85	1,71,21,22

APPENDIX F

Alternative Treatment/Recovery Technologies

Alternative Treatment/Recovery Technologies

Alternative Treatment/Recovery Technology Codes	Description
1	Incineration of solids
1a	Incineration of sludges
1b	Incineration of liquids
1c	Incineration of gases
2	Reuse as fuel of solids
2a	Reuse as fuel of sludges
2b	Reuse as fuel of liquids
3	Solvent extraction
4	Fractionation or batch still distillation
5	Carbon adsorption
6	Biological treatment
7	Incineration of solids followed by stabilization of the ash and chromium reduction followed by metals precipitation of scrubber water with stabilization of treatment sludge
7a	Incineration of sludges followed by stabilization of the ash and chromium reduction followed by metals precipitation of scrubber water with stabilization of treatment sludge
7b	Incineration of liquids followed by stabilization of the ash and chromium reduction followed by metals precipitation of scrubber water with stabilization of treatment sludge
8	Solvent extraction followed by steam stripping and carbon adsorption
9	Retorting followed by stabilization of the ash
10	Cement based or pozzolanic stabilization
11	Thin film evaporation
12	Cyanide oxidation followed by chemical precipitation, sludge dewatering, and stabilization of the sludge
13	Wet air oxidation followed by carbon adsorption, chemical precipitation, sludge dewatering, and stabilization of the sludge
14	Slurrying followed by cyanide oxidation, chemical precipitation, sludge dewatering, and stabilization of the sludge

Alternative Treatment/Recovery Technologies (continued)

Alternative Treatment/Recovery Technology Codes	Description
15	Chemical precipitation, sludge dewatering, and stabilization of the sludge
16	Slurrying followed by chemical precipitation, sludge dewatering, and stabilization of the sludge
17	Chrome reduction followed by chemical precipitation, sludge dewatering, and stabilization
18	Slurrying followed by chrome reduction, chemical precipitation, sludge dewatering, and stabilization
19	Cyanide oxidation
20	Slurrying followed by cyanide oxidation
21	Wet air oxidation followed by carbon adsorption
22	Wet air oxidation followed by biological treatment
23	Solvent extraction followed by steam stripping
24	Steam or air stripping followed by carbon adsorption
25	Fractionation, batch still distillation, or solvent extraction followed by incineration of the organic stream
26	Rotary kiln or fluidized bed incineration
27	Rotary kiln or fluidized bed incineration of sludges followed by stabilization of the ash and metals precipitation of scrubber water with stabilization of treatment sludge
28	Chlorination followed by vacuum filtration, followed by sulfide precipitation, filtration, and sludge dewatering of the filtrate from the vacuum filter
29	Solvent extraction followed by incineration or reuse as fuel of the extract and steam stripping and carbon adsorption of the wastewater
30	Secondary smelting
31	Secondary smelting followed by stabilization of the slag
32	Chromium reduction followed by chemical precipitation and vacuum filtration
33	Chromium reduction followed by chemical precipitation and sludge dewatering
34	Liquid injection incineration or reuse as fuel

Alternative Treatment/Recovery Technologies (continued)

Alternative Treatment/Recovery Technology Codes	Description
35	Incineration followed by dissolving of the ash, sulfide precipitation, sludge dewatering, and stabilization
36	Carbon adsorption followed by chromium reduction, chemical precipitation, sludge dewatering and stabilization
37	Solids blending
38	Neutralization
39	Electrochemical cyanide oxidation followed by alkaline chlorination, chemical precipitation, sludge dewatering, and stabilization
40	Wet air oxidation, followed by carbon adsorption, chromium reduction, chemical precipitation, sludge dewatering, and stabilization
41	Reuse as fuel of solids followed by stabilization of the ash from boilers and process heaters
41a	Reuse as fuel of sludges followed by stabilization of the ash from boilers and process heaters
41b	Reuse as fuel of liquids followed by stabilization of the ash from boilers and process heaters
42	Stripping followed by carbon adsorption, chromium reduction, chemical precipitation, sludge dewatering, and stabilization
43	Wet air oxidation followed by carbon adsorption, chromium reduction, chemical precipitation, sludge dewatering, and stabilization
44	Steam stripping followed by chemical precipitation, sludge dewatering, and stabilization
45	Sulfide precipitation followed by sludge dewatering and stabilization
46	Slurrying followed by sulfide precipitation, sludge dewatering, and stabilization
47	Cyanide oxidation followed by sulfide precipitation, sludge dewatering, and stabilization

Alternative Treatment/Recovery Technologies (continued)

Alternative Treatment/Recovery Technology Codes	Description
48	Wet air oxidation, followed by carbon adsorption, sulfide precipitation, sludge dewatering, and stabilization
49	Cyanide oxidation followed by chemical precipitation, sludge dewatering and stabilization
50	Slurrying followed by cyanide oxidation, chemical precipitation, sludge dewatering, and stabilization
51	The waste already meets BDAT treatment standard
53	Lab pack waste
55	Total recycle of K069
56	Incineration of solids followed by stabilization of the ash and chemical precipitation of the scrubber water followed by sludge dewatering and stabilization
56a	Incineration of sludges followed by stabilization of the ash and chemical precipitation of the scrubber water followed by sludge dewatering and stabilization
56b	Incineration of liquids followed by stabilization of the ash and chemical precipitation of the scrubber water followed by sludge dewatering and stabilization
56c	Incineration of gases followed by stabilization of the ash and chemical precipitation of the scrubber water followed by sludge dewatering and stabilization
58	Sludge dewatering followed by incineration of the solids with stabilization of the ash. Chromium reduction and chemical precipitation of the scrubber water followed by sludge dewatering and stabilization and oil skimming followed by chromium reduction, chemical precipitation, and sludge dewatering and stabilization, of the liquid effluent from the original dewatering
59	Carbon adsorption followed by sulfide precipitation sludge dewatering and stabilization

Alternative Treatment/Recovery Technologies (continued)

Alternative Treatment/Recovery Technology Codes	Description
60	Biological treatment followed by sulfide precipitation, sludge dewatering and stabilization
61	Incineration of liquids followed by stabilization of the ash and chromium reduction, sulfide precipitation of the scrubber water followed by sludge dewatering and stabilization
62	Slurrying followed by general oxidation, sulfide precipitation, sludge dewatering, and stabilization
63	Oil skimming followed by incineration of the sludge with stabilization of the ash. Chromium reduction, chemical precipitation of the scrubber water followed by sludge dewatering and stabilization, and chromium reduction followed by chemical precipitation, sludge dewatering, and stabilization of the liquid effluent.
64	Oil skimming followed by chromium reduction, chemical precipitation, sludge dewatering, and stabilization of the liquid effluent. Reuse as fuel of the sludges followed by stabilization of the ash from boilers and process heaters.
65	Cyanide oxidation followed by chromium reduction, chemical precipitation, sludge dewatering, and stabilization
66	Wet air oxidation followed by chromium reduction, chemical precipitation, sludge dewatering, and stabilization
67	General oxidation with hydrogen peroxide or potassium permanganate
68	Carbon adsorption followed by chemical precipitation sludge dewatering and stabilization
69	Steam stripping followed by chromium reduction, chemical precipitation, sludge dewatering and stabilization
70	Mixed RCRA/radioactive wastes
71	Thermal regeneration of carbon